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(6) OPERATION CROSSROADS.

U.S.S. RHIND (DD 404)

(8)

TEST ABLE (U).

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CONFIDENTIAL

BUREAU OF SHIPS GROUP

TECHNICAL INSPECTION REPORT

... Atomic Support Agency,
Washington, D. C. 20301

APPROVED:

F.X. Forest,
Captain, U.S.N.

SECRET

USS RHIND (DD404)

Page 1 of 134 Pages

CONFIDENTIAL

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U.S.S. RHIND (DD404)

SHIP CHARACTERISTICS

Building Yard: Philadelphia Naval Shipyard.

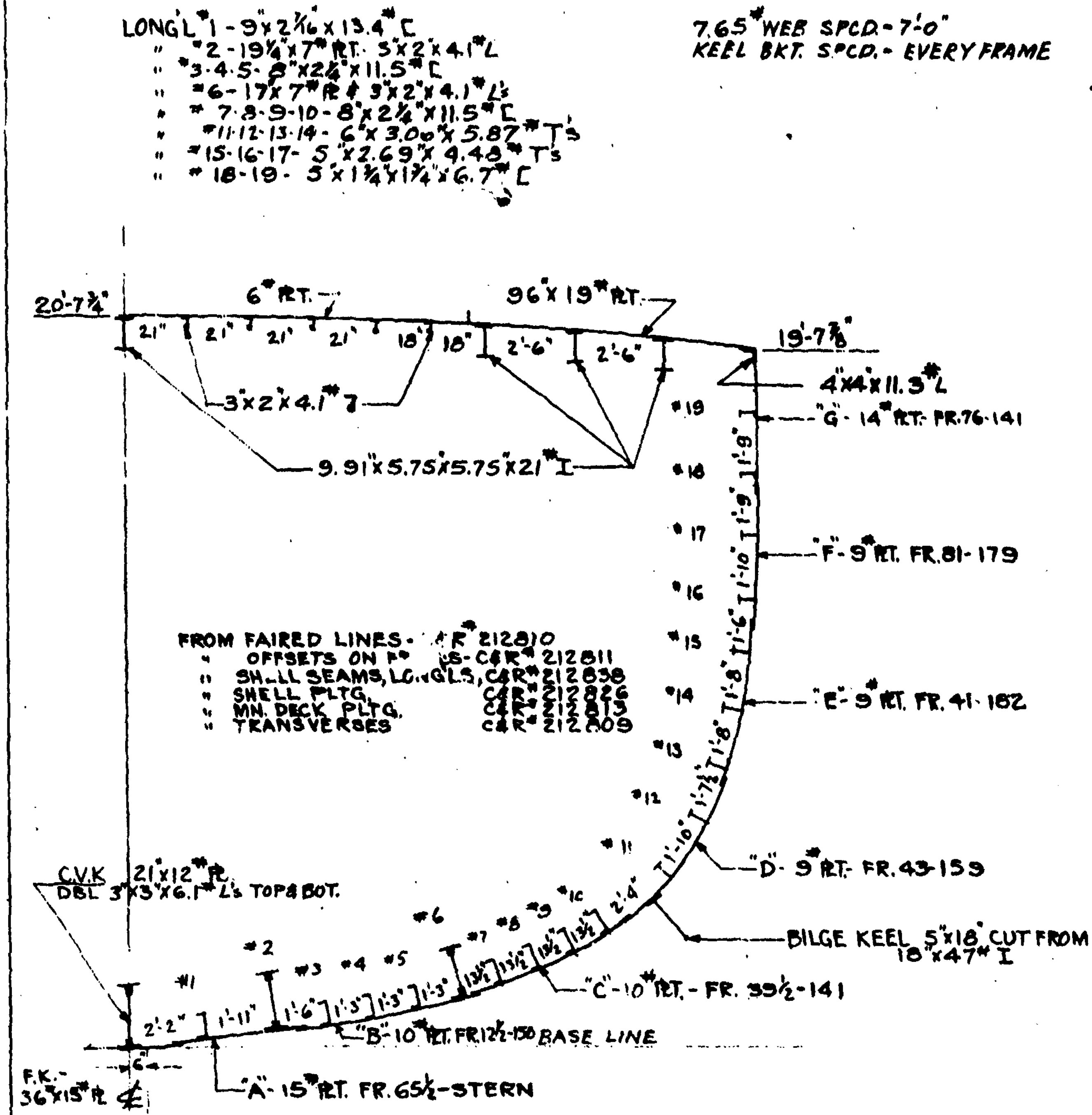
Commissioned: 10 November 1939.

HULL

Length Overall: 340 feet 9 inches.
Length on Waterline: 334 feet 0 inches.
Beam (extreme): 35 feet 6 inches.
Depth (molded at side, to main deck, amidships): 19 feet 7 7/8 inches.
Drafts at time of test: Fwd. 12 feet 9 inches.
Aft. 12 feet 9 inches.
Standard displacement: 1,500 tons.
Displacement at time of test: 2,220 tons.

MAIN PROPULSION PLANT

Main Engines: Two sets of Westinghouse main turbines are installed, one set per shaft.
Reduction Gears: Two sets of "Falk" double reduction are installed, one set per shaft.
Main Condensers: Two are installed in ship.
Boilers: Three Babcock and Wilcox boilers are installed in ship. 565 psi. gauge - 705° F.
Propellers: Two are installed in ship.
Main Shafts: Two are installed.
Ships Service Generators: Four are installed in ship. Two 132 KW. - A-C., and two 40 KW. D.C. units.



MIDSHIP SECTION FR. 96

TEST A

USS RHIND (DD 404)

8402

TECHNICAL INSPECTION REPORT

OVERALL SUMMARY

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

There was no flooding, hence no change in drafts or list.

(b) Structural damage.

HULL

In general, all starboard and forward superstructure and deckhouse bulkheads are damaged. The extent of the damage varies from dishing to a depth of 1 1/2 inches in the cases of the midship and after deckhouse, to rupture of a bulkhead on the 02 level. All weather doors and light structures such as 20mm gun bulwarks, ladders, and catwalks on the starboard side of the ship are badly damaged.

The shell plating on the starboard bow is slightly dished with accompanying slight distortion of the webs of stiffening girders in way of lightening holes or cutouts.

The foremast and mainmast are bent aft and to port. All radio antennae are down. The antennae for most of the electronic equipment is distorted.

MACHINERY

The stack broke completely off about 4 feet abov its base and fell over the port side. The stub stack remaining wa: torn apart at the starboard after corner. The breeching between uptakes and stack (above main deck) was badly crushed, and was ripped and torn on the starboard side.

ELECTRICAL

The forward bulkheads of the CIC room gave way causing damage to wiring and fittings secured to it and the steering tramsmitter in the pilot house above.

A bent frame in the starboard side of the after fireroom caused the compressor controller panel to crack.

(c) Other damage.

HULL

Not observed.

MACHINERY

The b ickwork of boiler #1 was severely damaged. Damage to stack and uptake breeching is described under (b) above. The steam line to whistle and siren, and the atmospheric exhaust pipe, which are attached to the stack, were bent into "U" shape and are hanging over the port side. The whistle and siren went overboard with their piping. The starboard motor whaleboat engine was badly damaged. Several nipples in small piping were broken.

ELECTRICAL

All electrical equipment other than radio and radar was operable except the 36" searchlight, the steering transmitter in the pilot house and a type "j" rotary switch in turret #2.

II. Forces Evidenced and Effects Noted.

(a) Heat.

HULL

Heat radiation emanated from about 50 degrees relative and at an elevation of about 15 degrees. Paint scorching is considerable and is more pronounced than blistering. Vertical surfaces showed

very slight scorching. Paint damage is confined to a depth of about .002 inches. Cordage and firehoses are considerably scorched where directly exposed to the radiation.

MACHINERY

Paint on the starboard side of deck machinery is scorched and blistered.

ELECTRICAL

Radiant heat was apparent from approximately 65 degrees relative. No damage to electrical equipment occurred other than the scorching of surfaces exposed.

(b) Fires and explosions.

HULL

Canvas bloomers on #1 and #4 gun mounts were completely burned.

A manila davit fall at frame 80, starboard, main deck, burned. It is believed that this ignited the gangway sea painter and lagging on the mainstay nearby. Fires were apparently caused by direct heat radiation. There were no explosions.

MACHINERY

No evidence.

ELECTRICAL

No fires or explosions occurred to electrical equipment.

(c) Shock.

HULL

None.

MACHINERY

No evidence.

ELECTRICAL

No shock was noted other than secondary shock caused by structural failures which is evidenced by the steering transmitter failure in pilot house.

(d) Pressure.

HULL

The direction of the pressure wave was from a point bearing about 60 degrees relative. The pressure wave caused slight dishing of the starboar shell and superstructure bulkheads, slight dishing of the starboard sides of gun shields, and moderate dishing of all weather doors. 5 pound bulwarks around 20mm guns on the starboard side are damaged. The stack is missing. The uptakes are heavily distorted. The foremast is bent aft and to port. Light nonstructural sheet metal structures are generally badly damaged where exposed.

MACHINERY

A heavy blast pressure struck the ship from the starboard side. This and the resultant whipping motion of the ship caused all the damage described above.

ELECTRICAL

Slight damage to electrical equipment by pressure was noted at the 36'' searchlight, also in way of cables on the mast and the collapsing of the CIC bulkhead which affected the steering transmitter.

(e) Effects peculiar to the atomic bomb.

HULL

Radioactivity and the intense heat are the only effects peculiar to the atom bomb.

MACHINERY

A blast pressure of this magnitude is apparently peculiar to the atom bomb.

ELECTRICAL

No effects to electrical equipment were apparent.

III. Results of Test on Target.

(a) Effect on machinery, electrical, and ship control.

HULL

Not observed.

MACHINERY

Boiler #1 is inoperable. Repairs to brickwork could be made by the ship's force in about 3 days. All other damage to machinery is minor and would not affect operation. Damage to the stack would prevent operation except at low speed and under favorable wind conditions, because of stack gasses entering the engine rooms' ventilation. Emergency repairs to the uptakes breeching and the stub stack requiring about 1 day would improve this condition, but not sufficiently to permit normal operation. The atmospheric exhaust line, which was bent over and flattened, had to be punctured to allow steaming of any boiler.

ELECTRICAL

No effect occurred to electrical machinery. Slight damage occurred to ship control in the way of the pilot house steering transmitter.

(b) Effect on gunnery and fire control.

HULL

Not observed.

MACHINERY

No comment.

ELECTRICAL

No electrical effect on gunnery occurred.

Slight effect on fire control occurred due to the casualty to the 36'' searchlight.

(c) Effect on watertight integrity and stability.

HULL

None.

MACHINERY

No comment.

ELECTRICAL

No electrical effect on watertight integrity and stability occurred.

(d) Effect on personnel and habitability.

HULL

The habitability is unimpaired.

MACHINERY

It is not believed that there would have been any casualties among personnel below decks. Exposed personnel would have suffered heavily. The test had no appreciable effect on habitability except for the effect of stack gasses drawn into the ventilation system (see "a" above).

ELECTRICAL

No effect occurred due to electrical damage.

(e) Effect on fighting efficiency.

HULL

The principal effects on fighting efficiency result from loss of the stack and failure of the masts. The latter would render most of the electronic equipment inoperable.

MACHINERY

Damage to the stack and to #1 boiler greatly reduced the vessel's ability to steam and limited courses she could steer to those providing favorable wind conditions. It is estimated that approximately 20 days work at a shipyard would be required to restore normal operating conditions.

ELECTRICAL

Effect on fighting efficiency by electrical damage was negligible being confined to the 36'' searchlight.

IV. General Summary of Observers Impressions and Conclusions.

HULL

The most serious effect of the hull damage is the failure of the foremast with its accompanying damage to the electronics antennae. This damage to antennae renders the electronic equipment inoperable. The general failure of all weather deck doors, even in areas where surrounding bulkheads suffered little distortion, is particularly noticable.

MACHINERY

The vulnerability of the stacks and the breeching between uptakes and stacks are on obvious point of weakness.

ELECTRICAL

All electrical damage was light and could be repaired by the ship's force except the 36'' searchlight. This ship could accomplish regularly assigned missions.

V. Preliminary Recommendations.

HULL

The necessity for attention to the design of stacks, masts, doors and aluminum structure is apparent.

MACHINERY

The stack should be made more resistant to blast pressure. The breeching between stack and uptakes should be redesigned or eliminated, as it offers little resistance to blast pressure.

ELECTRICAL

Recommendations are included with each individual item in part C, where applicable.

TECHNICAL INSPECTION REPORT

SECTION I - HULL

GENERAL SUMMARY OF HULL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

There was no flooding, hence no change in drafts or list.

(b) Structural damage.

In general, all starboard and forward superstructure and deckhouse bulkheads are damaged. The extent of the damage varies from dishing to a depth of 1 1/2 inches in the cases of the midship and after deckhouses, to rupture of a bulkhead on the 02 level. All weather doors and light structures such as 20MM gun bulwarks, ladders, and catwalks on the starboard side of the ship are badly damaged.

The shell plating on the starboard bow is slightly dished with accompanying slight distortion of the webs of stiffening girders in way of lightening holes or cutouts.

The foremast and main mast are bent aft and to port. All radio antennae are down. The antennae for most of the electronic equipment is distorted.

The stack has been blown over the port side.

(c) Other damage.

Not observed.

II. Forces Evidenced and Effects Noted.

(a) Heat.

Heat radiation emanated from about 50 degrees

relative and at an elevation of about 15 degrees. Paint scorching is considerable and is more pronounced than blistering. Vertical surfaces showed very slight scorching. Paint damage is confined to a depth of about .002 inches. Cordage and firehoses are considerably scorched where directly exposed to the radiation.

(b) Fires and explosions.

Canvas bloomers on #1 and #4 gun mounts were completely burned. A manila davit fall at frame 80, starboard, main deck, burned. It is believed that this ignited the gangway sea painter and lagging on the mainstay nearby. Fires were apparently caused by direct heat radiation. There were no explosions.

(c) Shock.

None.

(d) Pressure.

The direction of the pressure wave was from a point bearing about 60 degrees relative. The pressure wave caused slight dishing of the starboard shell and superstructure bulkheads, slight dishing of the starboard sides of gun shields, and moderate dishing of all weather doors. 5 pound bulwarks around 20MM guns on the starboard side are damaged. The stack is missing. The uptakes are heavily distorted. The foremast is bent aft and to port. Light non-structural sheet metal structures are generally badly damaged where exposed.

(e) Effects peculiar to the atom bomb.

Radioactivity and the intense heat are the only effects peculiar to the atom bomb.

III. Results of Test on Target.

(a) Effect on machinery, electrical, and ship control.

Not observed.

(b) Effect on gunnery and fire control.

Not observed.

(c) Effect on watertight integrity and stability.

None.

(d) Effect on personnel and habitability.

The habitability is unimpaired.

(e) Effect on fighting efficiency.

The principal effects on fighting efficiency result from loss of the stack and failure of the masts. The latter would render most of the electronic equipment inoperable.

IV. General Summary of Observers' Impressions and Conclusions.

The most serious effect of the hull damage is the failure of the foremast with its accompanying damage to the electronics antennae. This damage to antennae renders the electronic equipment inoperable. The general failure of all weather deck doors, even in areas where surrounding bulkheads suffered little distortion, is particularly noticeable.

V. Preliminary Recommendations.

The necessity for attention to the design of stacks, masts, doors and aluminum structure is apparent.

VI. Instructions for Loading the Vessel Specified the Following:

ITEM	LOADING
Fuel oil	50%
Diesel oil	50%
Ammunition	50%
Potable and reserve feed water	Full load
Salt water ballast	160 tons.

Details of the actual quantities of the various items aboard are included in Report 7, Stability Inspection Report, submitted by the ship's force in accordance with "Instructions to Target Vessels for Tests And Observations by Ship's Force" issued by the Director of Ships Material. This report is available for inspection in the Bureau of Ships Crossroads Files.

DETAILED DESCRIPTION OF HULL DAMAGE

A. General Description of Hull Damage.

(a) Overall condition of vessel.

Although damage to the strength hull is limited to moderate dishing of the starboard shell, damage to the superstructure is extensive. The superstructure is so severely buckled and ruptured that the ship is rendered almost useless tactically. General views of the exterior are shown on pages 52 to 67 inclusive.

The principal damage is found on the starboard side where all the superstructure weather doors are rendered inoperable and all house sides are extensively dished. The worst damage to the house structure occurs on the 02 level where a riveted seam is ruptured and part of the CIC house side is blown in. Failure of rivets on the upper and lower bounding plates of this bulkhead is extensive. Failure of rivets in seams and on stiffeners in the dished areas is extensive. Several aluminum frames have failed. The house sides forward are also extensively dished, but the port sides suffered less damage. In this area some of the doors are jammed and some dishing of the house sides is observable.

The stack was blown off at the 01 level carrying with it the steam supply and drain lines to the whistle and siren, and the atmospheric exhaust. The stack itself carried away, leaving the attached lines hanging over the port side.

Both masts are badly bent and all antennae for radio and radar are demolished. The wave guide on the foremast is badly twisted and bent. The radar on the main battery director is also severely damaged, reducing the ship to optical fire control.

Damage below the main deck consists principally of moderate dishing of the starboard shell throughout the length of the ship. This dishing includes a certain amount of buckling and tearing of frame webs in way of lightening holes and cutouts for longitudinals. The damage is confined essentially to areas above the waterline with the maximum damage occurring between frames 15 and 50.

Although this area was already damaged prior to test A, the blast definitely aggravated the condition of the hull. Where face and collar plates are installed in way of lightening holes and cutouts for longitudinals there is no buckling or tearing of web frame.

(c) Apparent causes of hull damage in each area.

The apparent causes of damage to the ship are the blast loading of surfaces and slight shock damage.

(d) Principal areas of flooding with sources.

With the exception of minor leaks between tanks A-5-F, A-6-F, and A-8-V, which were opened by the working of the hull, no other internal flooding occurred.

(e) Residual strength, buoyancy, and effect of general condition of hull on operability.

The residual strength is only slightly affected by the damage to the shell. Buoyancy is unaffected. Damage to the superstructure renders the ship useless as a tactical unit. Damage to the smokestack permits only a very limited operation under favorable conditions although the main propulsion plant and the interior communication system could be used. Ship control is hampered but not put out entirely by damage to the navigating bridge.

B. Superstructure.

(a) Description of damage.

The blast struck the vessel from about 45 degrees relative, seriously damaging the forward and starboard sides of the superstructure.

The forward bulkhead of the bridge is dished about two inches. Two brackets connecting the overhead girders and bulkhead stiffeners have failed. One panel of this bulkhead is opened slightly in way of a riveted seam where the rivets failed. (Photographs 2005-5, page 68 , 2010-11, page 69 , and 17?2 1, page 70 .

Two ports are blown in, one has the glass shattered and the other is intact. These ports failed in the retaining ring threads. The venturi shield on the starboard bridge is somewhat distorted. The flag bags are demolished. The heaviest damage to any bulkhead or house side occurred on the 02 level. The CIC, starboard house side is demolished in way of the door. The damage consists principally of general failure of rivets, stiffeners, and aluminum plating. The rivets along the top and bottom bounding angles have failed over a distance of about 4 feet. In the after, centerline vertical seam, the rivets have failed along the entire height. The house side and the door are distorted inboard, breaking three frames in way of the damage. (Photographs 2003-1, page 71 and 1817-4, page 72.) The 02 deck level is dished slightly, port and starboard, at frame 56.

In general, all starboard bulkheads and house sides of the superstructure are heavily dished as much as six inches and all doors are dished and jammed. On the port side, this same situation exists to a lesser extent. In addition, some of the houses sides and bulkheads are dished outward. Several aluminum frames and stiffeners are broken in way of drilled holes in the flanges and webs. Many frames or stiffeners that did not break have definite strain lines visible as paint cracks around the holes.

There is a general failure throughout of bulwarks, 20mm gun shields, life lines, stanchions, and other light metal work. Ladders are bent, twisted, and torn from their fastenings, but in no case are the ladders unusable. Catwalks, too, are distorted. Especially the catwalk from the forecastle deck, aft, which is almost impassable in places. All radar antennae are either down or broken. Whip antennae, although broken, bent, or twisted seem to stand up best and are still serviceable after the test. (Photographs 2005-5, page 68, 2010-11, page 69, 1772-1, page 70, 1771-11, page 73, 2005-3, page 74, 2010-10, page 75, 2010-8, page 76, 2010-9, page 77, 2003-11, page 78, 2003-10, page 79, 2003-2, page 80, 1817-3, page 81.

Although the above damage would render the vessel practically useless for any tactical operation, the loss of the stack would preclude any mission in anything but a calm sea at low speed and with little or no relative head wind. The stack was blown completely off, breaking just above the uptake fairing strip. It carried

with it the steam supply and drain lines to the whistle and siren and the atmospheric exhaust pipe. The latter still remains hanging over the port side in the water.

The ship is still able to get up steam and get underway using the remaining uptakes. But in a head wind of any intensity the engine rooms would be untenable because of flue gases which would fill the engineering spaces. In addition, in any heavy sea the firerooms might be flooded from water entering the uptakes. (Photographs 2010-8, page 76 , 2010-9, page 77 , 2003-10, page 79 , and 1771-12, page 82 .

The foremast is severely damaged and twisted, rendering inoperable all radar antennae not torn off. The wave guide on the after side of the mast is broken and twisted. The foremast is bent aft and to port at the top of the main deck supporting brackets. About twelve feet above this point the mast is further bent in the same direction. A third kink occurs just above the padeyes to which the lower mast guys are secured. The forward guys are parted. The after guys have about 14 inches of slack. There is a further sharp bend just below the yardarm level. The yardarm is askew with respect to the rest of the mast. All signal halyards are either burned completely or torn off. (Photographs 2003-11, page 78 , 2003-2, page 80 , 2003-4, page 83 , 2200-2, page 84 , and 2200-9, page 85).

The mainmast is also bent aft and to port to a lesser degree than the foremast. The main bend occurs just above the pipe brace about 8 feet above the house top. The pipe braces are also slightly bent.

(b) Causes of damage in each area.

The cause of damage is generally directly attributable to blast and to the resulting movement of structure.

(c) Evidence of fire in superstructure.

All surfaces facing forward or to starboard were scorched. The heat was apparently intense enough to start several minor fires in manila lines and snaking, life line covers, and other

small combustible items. In no case could any of the fires be considered serious.

(d) Estimate of relative effectiveness against heat and blast.

It appears that all plating and framing are, in general, too light to resist damage at this range. Measures should be taken to prevent the drilling of holes in frames and beams.

(e) Constructive criticism of superstructure design or construction, including important fittings and equipment.

No comment.

C. Turrets, Guns and Directors.

(a) Protected mounts.

The sides of all four 5"/38 cal. mounts are dished about two inches in way of the blast. There is no other damage to the five inch mounts. All are operable and from all appearances and visual checks are capable of being fired.

(b) Unprotected mounts.

One recoil spring on the starboard 40mm mount is broken. Otherwise, all 40mm and 20mm guns function normally and from visual inspections seem capable of being fired.

(c) Directors and rangefinders.

The Mk 33 director can maintain optical control as the rangefinder and range keeper are not damaged. Since the radar antennae, its rotating dipole, and the stable element, are broken, all radar control is lost. The director shield is dished and some of the welded seams are parted, but this does not hinder the operation of the director.

One of the two Mk 51 directors is still operable. The handle of the other is bent downward and around the stand, preventing movement. The power lead and the sight on the damaged director

is also broken. Apparently it was sheared off by the demolished splinter shield.

The ray filters on the Mk 14 sights of the starboard 20mm are jammed. Otherwise the sights are operable. (Photographs 2010-11, page 69 , 1772-1, page 70 , 2003-3, page 86 , 2010-12, page 87 , and 1817-6, page 88 .

(d) Constructive criticism of design or construction of mounts, directors, foundations and shelters.

No comment.

D. Torpedo Mounts, Depth Charge Gear.

(a) Torpedo mounts.

There is no material damage to the torpedo mounts. The torpedoes in the port mount, which was trained to 270 degrees, were knocked loose and now extend about three feet out from their normal position. This movement was caused by either the rapid roll and/or the high speed lateral displacement of the ship in the water caused by the blast pressure. The motion of the vessel and the inertia of the torpedoes produced a resultant force sufficient to break the tension lock holding the torpedoes in place. This force did not operate either the inertia starter or the starting lever. The torpedoes did not run and still have full air charges (photograph 1772-2, page 89).

(b) Depth charge gear.

There is no material damage to the depth charge gear.

E. Weather Deck.

(a) General condition of the deck and causes of damage.

The weather decks are generally in sound condition. A few rivet leaks were found on the 02 level abaft No. 2 gun. A minor amount of buckling occurs which in no way decreases the strength or watertightness of the ship.

(b) Usability of deck in damaged condition.

The deck is usable.

(c) Condition of equipment and fittings.

No further damage was noted other than the bending of some life line stanchions and dishing of some of the bulwarks. They are all still serviceable except for an 8 foot section at frame 75, port, which was carried away by the falling stack.

F. Exterior Hull.

(a) Condition of exterior hull plating and causes of damage.

Although the hull is structurally sound and watertight after the test, a minor amount of dishing of the shell above the waterline occurs throughout the starboard side. It exists essentially between the main deck and first platform with the maximum deflection forward and diminishing to an almost negligible amount aft. It is most serious between frames 15 to 50 with a maximum of about 1 inch indentation at frame 38. In general, the dished panels extend between web frames and from deck to deck with the shell longitudinals conforming without distortion to the dish of the plating. A certain amount of failure, however, is noticeable in the webs of transverse web frames in way of lightening holes and cut outs for longitudinals where collars are not installed. The fact that the maximum deflection occurred at a point of structural discontinuity at the forward end of the superstructure, frame 38, indicates probability of transverse whipping. (Photographs 1895-1, page 90 , 1895-2, page 91 , and 1895-3 page 92).

(b) Condition of exterior hull fittings and causes of damage.

No damage.

(c) Details of any impairment of shear strakes.

None observed.

(d) Condition of side armor, if fitted externally.

Not applicable.

G. Interior Compartments (Above Waterline).

(a) Damage to structure and causes.

A 7# plate bracket adjacent to the starboard shell just under the main deck at frame 44 is buckled aft 3/4 of an inch in the web.

Bulkhead 64, between the main and forecastle deck is severely dished forward, on both port and starboard sides where exposed to the blast. On the starboard side, the quick acting door is distorted and inoperable. On the port side the quick acting door is dished and jammed, but remains tight.

Web frame 54, starboard, in the wardroom, is buckled in the web in way of a lightening hole 2 1/2 feet below the forecastle deck. This hole has no face plate.

Between the main deck and first platform, starboard, moderate shell dishing and buckling of frame webs were found at frames 21, 28, 32, 40, 44, 46, 159, and 163. Bulkheads 25 and 36 are dished forward at the starboard shell. Web failure occurs between the main deck and first platform almost without exception in way of lightening holes and cut outs for longitudinals where collars or face plates were not installed.

This structural damage is in addition to that already discussed under Item F, Exterior Hull.

(b) Damage to joiner bulkheads and causes.

Some joiner bulkheads are slightly distorted as a result of both the permanent distortions of the ship girder and the apparently high speed flexure during the blast and shock.

(c) Details of damage to access closures and fittings.

Access closures and fittings are undamaged below the weather decks. In the superstructure, weather doors are dished and jammed severely on the starboard side and less severely on the port side.

(d) Condition of equipment within compartments.

A porcelain washbowl in stateroom 103, starboard, frame 37 1/2, is broken. This is the only evidence, other than possibly the movement of the port torpedoes, that indicates there was a shock wave.

(e) Evidence of fire.

None.

(f) Damage in way of piping, cables, ventilation ducts, etc.

None.

(g) Estimate of reduction in watertight subdivision, habitability and utility of compartments.

The damage did not affect the habitability, the strength, or the watertight integrity of the ship in these compartments.

H. Armor Decks.

Not applicable.

I. Interior Compartments (Below w.l.).

(a) Damage to structure and causes.

The damage found in the underwater compartments is similar to but less than that found above the waterline. This area was damaged prior to the test, but there is evidence to indicate an aggravation of the damage as a result of the test.

Web frame 64, starboard, is buckled in the web and is further torn in way of a shell longitudinal. Web frames 76, 90, and 94 are buckled in the web in way of lightening holes that have no face plates.

Longitudinals in general are not damaged except for uniform moderate deflection in way of shell dishing.

(b) Damage to joiner bulkheads and causes.

None.

(c) Details of damage to access closures and causes.

None.

(d) Condition of equipment within compartments.

In the forward 5" magazine, A-406-M, several stowage battens were thrown out of their sockets and ammunition cans are spilled on deck. In magazine A-405-M, one batten is jarred loose.

(e) Flooding.

None.

(f) Damage in way of piping, cables, ventilation ducts, shafts, etc.

None.

(g) Estimate of reduction in watertight subdivision, habitability or utility of spaces.

No reduction.

J. Underwater Hull.

(a) Interior inspection of underwater hull.

Other than the damage discussed in Item I, there is no

damage to the underwater hull.

(b) Effect of damage on buoyancy, operability.

Buoyancy and operability not affected.

(c) Any known or suspected damage.

There is no suspected or known damage to shafts, propellers, struts, rudders or external keels.

(d) Details of impairment of keel structure.

There is no known damage to keel structure.

K. Tanks.

(a) Condition of tanks in area of damage.

There was no damage found to any tanks except slight fuel oil leaks between A-5-F, A-6-F, and A-8-V.

(b) Contamination of liquids.

No contamination is known or suspected.

(c) Damage (known or suspected) to torpedo defense systems.

Not applicable.

L. Flooding.

No flooding occurred.

M. Ventilation.

(a) Damage to ventilation systems and causes.

There is no damage to internal ventilation. Exposed ducts are dished, bent, and twisted and closures distorted. All

ventilation is operable. The damage incurred does not affect the habitability of the ship.

(b) Evidence that ventilation system conducted heat, blast, fire or smoke below decks.

None.

(c) Evidence that ventilation allowed progressive flooding.

None.

(d) Constructive criticism of design and construction of system.

No comment.

N. Ship Control.

(a) Damage to ship control stations and causes.

The most serious hindrance to ship control exists in the loss of external communications. The 12 inch searchlights remain operable but flag hoist and radio communications are destroyed. However, temporary antennae and signal halyards could be rigged in a relatively short time. The CIC is completely out of service. Although a few temporary repairs could be made, only voice radio circuits at the most could be guarded. The Sound Power and other internal communications systems, in general, remain in good condition.

The wheel in the pilot house operates so stiffly that it cannot be used. The after steering station could be used and control of the ship could be maintained on the bridge.

(b) Constructive criticism of ship control systems.

No comment.

O. Fire Control.

(a) Damage to fire control stations and causes.

No damage other than that discussed in Item B.

(b) List of stations having insufficient protection and estimated effect on fighting efficiency and the loss of each.

No comment.

(c) Constructive criticism of location and arrangement of stations.

No comment.

P. Ammunition Behavior.

(a) Ready service ammunition, location, protection, behavior, under heat and blast.

The ammunition was not affected.

(b) Magazines, location, protection, forces involved, behavior.

In A-406-M, several stowage battens were thrown out of their sockets and allowed 5'' ammunition cans to spill on deck. In A-405-M, battens are jarred loose.

(c) List of stowages which are insufficiently protected and effects on ship survival of explosion of each stowage.

No ammunition burned or exploded.

(d) Behavior of gasoline stowage facilities.

No comment.

Q. Ammunition Handling.

(a) Condition and operability on ammunition handling devices.

No known damage occurred.

(b) Evidence that any ammunition handling device contributed to passing of heat, fire, blast, or flooding water.

None.

(c) Constructive criticism of design and construction of ammunition handling devices.

No comment.

R. Strength.

(a) Permanent hog or sag.

There is no evidence of permanent hog or sag.

(b) Shear stress in hull plating.

There are no evidences of shear strains.

(c) Evidence of transverse or racking strains.

The fact that the maximum deflection of the starboard shell plating occurs at frame 38, which is also the forward end of superstructure, indicates the possibility of transverse whipping.

(d) Details of any local failures in way of structural discontinuities.

No comment.

(e) Evidence of panel deflection under blast.

The starboard shell has dished areas. Scratch gage readings indicate an elastic vibration of the main deck.

(f) Turret, machinery and gun foundations.

No damage.

S. Miscellaneous.

(a) Evidence of heat damage variations under various colors of camouflage painting.

All surfaces facing forward and to starboard were scorched.

(b) Other miscellaneous effects or conditions noted during inspection.

No comment.

TECHNICAL INSPECTION REPORT

SECTION II - MACHINERY

GENERAL SUMMARY OF MACHINERY DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

No data taken by machinery group.

(b) Structural damage.

The stack broke completely off about 4 feet above its base and fell over the port side. The stub stack remaining was torn apart at the starboard after corner. The breeching between uptakes and stack (above main deck) was badly crushed, and was ripped and torn on the starboard side.

(c) Other damage.

The brickwork of boiler #1 was severely damaged. Damage to stack and uptake breeching is described under (b) above. The steam line to whistle and siren, and the atmospheric exhaust pipe, which are attached to the stack, were bent into "U" shape and are hanging over the port side. The whistle and siren went overboard with their piping. The starboard motor whaleboat engine was badly damaged. Several nipples in small piping were broken.

II. Forces Evidenced and Effects Noted.

(a) Heat.

Paint on the starboard side of deck machinery is scorched and blistered.

(b) Fires and explosions.

No evidence.

(c) Shock.

No evidence.

(d) Pressure.

A heavy blast pressure struck the ship from the starboard side. This and the resultant whipping motion of the ship caused all the damage described above.

(e) Effects apparently peculiar to the atom bomb.

A blast pressure of this magnitude is apparently peculiar to the atom bomb.

III. Effects of Damage.

(a) Effect on machinery and ship control.

Boiler #1 is inoperable. Repairs to brickwork could be made by the ship's force in about 3 days. All other damage to machinery is minor and would not affect operation. Damage to the stack would prevent operation except at low speed and under favorable wind conditions; because of stack gases entering the engine rooms' ventilation. Emergency repairs to the uptakes breeching and the stub stack requiring about 1 day would improve this condition, but not sufficiently to permit normal operation. The atmospheric exhaust line, which was bent over and flattened, had to be punctured to allow steaming of any boiler.

(b) Effect on gunnery and fire control.

No comment.

(c) effect on water-tight integrity and stability.

No comment.

(d) Effect on personnel and habitability.

It is not believed that there would have been any casualties among personnel below decks. Exposed personnel would have suffered heavily. The test had no appreciable effect on habitability except for the effect of stack gases drawn into the ventilation system (see "a" above).

(e) Total effect on fighting efficiency.

Damage to the stack and to #1 boiler greatly reduced the vessel's ability to steam and limited courses she could steer to those providing favorable wind conditions. It is estimated that approximately 20 days work at a shipyard would be required to restore normal operating conditions.

IV. General Summary.

The vulnerability of the stacks and the breeching between uptakes and stacks are an obvious point of weakness.

V. Preliminary Recommendations.

The stack should be made more resistant to blast pressure. The breeching between stack and uptakes should be redesigned or eliminated, as it offers little resistance to blast pressure.

DETAILED DESCRIPTION OF MACHINERY DAMAGE

A. General Description of Machinery Damage.

(a) Overall condition.

Main propulsion power is greatly reduced because of damage to #1 boiler and the stack. This would permit stack gases to enter the after ventilation systems. The ship's force could repair #1 boiler in about 3 days, permanent repairs to the stack would require yard availability.

(b) Areas of major damage.

Major damage occurred to the stack and to breeching between stack and uptakes.

(c) Primary cause of damage in each area of major damage.

Blast pressure.

(d) Effect of target test on overall operation of machinery plant.

The effect on operability of the machinery plant was to greatly reduce the speed of the vessel and to limit her maneuverability, as favorable wind directions are required to prevent stack gases from entering the ventilation systems. With the stack hanging over the side, the ship shifted berths under her own power, using maximum speed of 10 knots. During this operation the stack broke loose from the pipes holding it and fell into the water. Even at this slow speed, stack gases entering the engine room ventilation systems caused some difficulty.

B. Boilers.

(a) Air casings.

Undamaged. A careful visual inspection was made. Comparison of speed of blowers required to maintain a given air pressure in boilers indicates no change in any of them.

(b) External fittings.

Undamaged.

(c) Fuel oil burner assemblies.

Undamaged.

(d) Brickwork and furnaces.

Brickwork of boiler #1 was severely damaged. The front wall on the saturated side is badly cracked and crumbling, (See Photo 2003-8, page 93) and would collapse if extended operation underway were attempted. The rear wall on the saturated side has a crack extending from top to bottom. (See Photo 2003-6, page 94). On the superheater side, both front and rear walls are badly cracked. It is estimated that repairs could be made by the ship's force in about 3 days.

Brickwork of the other boilers is undamaged.

(e) Steam, water drums and headers.

Undamaged. Hydrostatic tests indicate no change in the tightness of the boilers.

(f) Tubes.

Undamaged. See "e" above.

(g) Foundations.

Undamaged.

(h) Stacks and uptakes.

The stack was completely torn off about 4 feet above the top of the uptake breeching. It hung over the port side suspended from the atmospheric exhaust and whistle pipes (which were bent over but not broken) until the ship got underway to shift berths. The stack then broke loose and carried away. (see Photo 2005-4, page

The portion of the stack remaining was torn apart at the starboard after corner. (See Photo 2003-12, page). The uptake breeching was badly crushed. (2170-1, 2 and 4, 2005-1 and 2; pages , , , , and). On the starboard side, the breeching was torn open and ripped down to its base even with the main deck.

It is estimated that emerg ency repairs to the uptake breeching, and closure of the rent in the stub stack remaining, could have been made by the ship's force within about one day. This would permit steaming at slow speed under certain favorable conditions of wind, but would allow stack gases to enter the ventilation systems of the engine rooms if the wind were from ahead. Permanent repairs would require an estimated 20 days work at a shipyard.

(i) General comment.

After the test, the ship shifted berths under her own power, steaming boilers #2 and #3 at about 25% full load and making speeds up to 10 knots. Under these conditions, some difficulty was experienced from stack gases entering the engine room ventilation intakes.

C. Blowers.

The nipple in the cooling water line to #4 blower broke. It was replaced by the ship's force.

There was no other damage to forced draft blowers, all of which were operated after Test A and functioned normally.

D. Fuel Oil Equipment.

Undamaged. Equipment in both firerooms was used satisfactorily incident to operation of boilers.

E. Boiler Feedwater Equipment.

Undamaged. Feedwater equipment has been operated satisfactorily in connection with operation of main engines.

F. Main Turbines.

Undamaged. The main turbines have been operated ahead and astern at speeds up to 10 knots with no difficulty.

Leads left in the bearings of the port low pressure turbine indicate motion of the rotors up to a possible maximum of .011 inch. This is attributed to the whipping motion following the blast.

BEARING LEAD DATA

PORT L. P. TURBINES - FORWARD BEARING

Forward lead	Before Test A	After Test A	Difference
Port	.011	.005	.006
Top	.013	.0075	.0055
Stb'd	.007	.005	.002
After lead			
Port	.014	.005	.009
Top	.016	.009	.007
Stb'd	.009	.004	.005

PORT L.P. TURBINE - AFTER BEARING

Forward lead	Before Test A	After Test A	Difference
Port	.011	.005	.006
Top	.014	.013	.001
Stb'd	.008	.006	.002
After lead			
Port	.016	.005	.011
Top	.014	.007	.007
Stb'd	.009	.005	.004

G. Reduction Gears.

Undamaged. The gears were inspected through the inspection plates while jacking over. The lubrication system was satisfactory. The gears operated normally while the main engines were in use.

H. Shafting and Bearings

Undamaged. The shafting and bearings showed no defects during operation of the main engines.

I. Lubrication System.

Undamaged. The lubrication system was checked during operation of the main engines. Performance was normal.

J. Condensers and Air Ejectors.

Undamaged. Condensers and air ejectors operated satisfactorily during operation of the main engines.

K. Pumps.

A nipple on the cooling water line to #1 fuel oil service pump was broken. It was replaced by the ship's force.

There was no other damage to pumps, all of which have been operated after Test A, and functioned normally.

L. Auxiliary Generators.

Undamaged. Both auxiliary generators were operated under load after Test A. Performance was normal.

M. Propellers.

Undamaged. The propellers were not inspected but were checked while the ship was underway. Performance was normal.

N. Distilling Plant.

Undamaged. The distilling plant has operated satisfactorily at normal capacity and quality of water since Test A.

O. Refrigerating Plant.

Undamaged. The refrigerating plant has operated satisfactorily in all respects since Test A.

P. Winches, Windlasses and Capstans.

Undamaged. All deck machinery was operated after the test and functioned normally.

Q. Steering Engine.

Undamaged. The steering engine was operated while the ship was underway and functioned normally.

R. Elevators, Ammunition Hoists, etc.

Undamaged. All units have been tested and operated satisfactorily.

S. Ventilation (Machinery).

Undamaged. All ventilation machinery was tested and found to be satisfactory.

T. Air Compressors.

Undamaged. The high pressure air compressor had been removed from the ship before the test. The low pressure air compressor operated satisfactorily after the test.

U. Diesels.

The diesel generator is undamaged. It was operated under load after Test A, and functioned normally.

The starboard motor whaleboat had a large quantity of water thrown over it, knocking off the engine cover. Heavy corrosion has set in. The batteries were knocked over, spilling electrolyte. Small lines and the exhaust pipe were broken.

V. Piping.

A nipple on a small fresh water line in the crew's wash-room was ruptured.

The atmospheric exhaust pipe and the steam line to the whistle, which are attached to the stack, are bent into a "U" shape and are dangling over the port side. The whistle and siren went over the side with their piping and the stack.

There is no other damage to piping, all of which has been used at normal operating pressure since Test A.

W. Miscellaneous.

Laundry equipment operated satisfactorily after the test except for the drain fitting on the presser which had ruptured and was replaced by the crew.

The galley equipment is undamaged.

The machine shop equipment had been removed from the ship before the test.

TECHNICAL INSPECTION REPORT

SECTION III - ELECTRICAL

GENERAL SUMMARY OF ELECTRICAL DAMAGE

I. Target Condition After Test.

(a) Drafts after test; list; general areas of flooding, sources.

Drafts after test - Forward 12' 6" - Aft 12' 9" - Mean 12' 8".

No flooding noted in way of electrical equipment.

(b) Structural damage.

Structural damage is the cause of the majority of electrical casualties.

1. The forward bulkheads of the CIC room gave way causing damage to wiring and fittings secured to it and the steering transmitter in the pilot house above.

2. A bent frame in the starboard side of the after fireroom caused the compressor controller panel to crack.

(c) Other damage.

1. All electrical equipment other than radio and radar was operable except the 36" searchlight, the steering transmitter in the pilot house and a type "J" rotary switch in turret #2.

II. Forces Evidenced and Effects Noted.

(a) Heat.

Radiant heat was apparent from approximately 65° relative. No damage to electrical equipment occurred other than the scorching of surfaces exposed.

(b) Fires and explosions.

No fires or explosions occurred to electrical equipment.

(c) Shock.

No shock was noted other than secondary shock caused by structural failures which is evidenced by the steering transmitter failure in pilot house.

(d) Pressure.

Slight damage to electrical equipment by pressure was noted at the 36" searchlight, also in way of cables on the mast and the collapsing of the CIC bulkhead which affected the steering transmitter.

(e) Any effects apparently peculiar to the atom bomb.

No effects to electrical equipment were apparent.

III. Effects of Damage.

(a) Effect on propulsion and ship control.

No effect occurred to electrical machinery. Slight damage occurred to ship control in the way of the pilot house steering transmitter.

(b) Effect on gunnery and fire control.

No electrical effect on gunnery occurred.

Slight effect on fire control occurred due to the casualty to the 36" searchlight.

(c) Effect on water-tight integrity and stability.

No electrical effect on water-tight integrity and stability occurred.

(d) Effect on personnel and habitability.

No effect occurred due to electrical damage.

(e) Total effect on fighting efficiency.

Effect on fighting efficiency by electrical damage was negligible being confined to the 36" searchlight.

IV. General Summary of Observers' Impressions and Conclusions.

All electrical damage was light and could be repaired by the ship's force except the 36" searchlight. This ship could accomplish regularly assigned missions.

V. Any Preliminary General or Specific Recommendations of the Inspecting Group.

Recommendations are included with each individual item in part C, where applicable.

DETAILED DESCRIPTION OF ELECTRICAL DAMAGE

A. General Description of Electrical Damage.

(a) Overall condition.

The overall condition of the electric plant is essentially the same as before Test A.

(b) Areas of major damage.

No major damage occurred.

(c) Primary causes of damage in each area of major damage.

The primary cause of damage was the blast.

(d) Effect of target test on overall operation of electric plant.

The entire electrical plant was operable except as follows:

1. 36" searchlight.
2. Steering transmitter in the pilot house.
3. Blinker lights.

(e) Types of equipment most affected.

The electrical equipment most affected are the searchlights, signal lights and wiring on superstructure.

B. Electric Propulsion Rotating Equipment.

Not Applicable.

C. Electric Propulsion Control Equipment.

Not Applicable.

D. Generators - Ships Service.

No damage occurred.

E. Generators - Emergency.

No damage occurred. The diesel generator, which was operating during the test, continued to run until the fuel was exhausted.

F. tchboards, Distribution and Transfer Panels.

No damage occurred.

G. Wiring, Wiring Equipment and Wireways.

Damage to wiring and wireways was of a light nature as noted below:

1. Cable fittings and cables were torn loose when bulkhead in I.C. room ruptured.

2. Type "J" rotary switch in turret #2 had cover dented due to corner of turret being dented. This switch was inoperable.

3. Cable outside forward portside of the pilot house was torn loose by ruptured bulwark.

4. Cable up the starboard side of the formast is scorched lightly and bent between supports.

5. The shore connection box was torn loose from its welded support when deck house bulkhead caved in.

6. Special 660 cable installed around pilot house was scorched where exposed to the blast. This cable was not painted.

H. Transformers.

No damage occurred.

I. Submarine Propelling Batteries.

Not Applicable.

J. Portable Batteries.

No damage occurred other than the whale boat batteries in place. Three of the batteries have cracked cells. This boat received a heavy shock.

K. Motors, Motor Generator Sets and Motor Controllers.

No major damage occurred that could not be remedied by the ship's force and as noted below:

1. The steering selsyn transmitter on the bridge was binding due to the forward bolts securing the stator frame having stripped their threads causing the stator to be misalined with the rotor. The cause of this failure is believed due to shock created when the bulkhead gave way in compartment below.

2. The CO2 switches in the diesel room and the paint locker ventilation systems opened due to shock. When reset the systems were operable.

3. The air compressor control panel is cracked across the middle. It is operable without automatic features. This controller is mounted solidly on heavy ships frame in after fire room. Cause of the panel breaking was the bending of the frame.

L. Lighting Equipment.

Very slight damage occurred.

1. A lighting fixture in the pilot house was hanging by the cable. The supporting screws were out and were not found. The cause of these screws coming out is not known.

2. Eleven rough service bulbs were broken.

M. Searchlights.

Major damage to searchlights occurred as follows:

1. The 36" searchlight was made inoperable. The carriage was knocked out of line and the carbon feed mechanism was out of order. The left hand elevation instrument dial had glass broken, the right hand train instrument glass was frosted from heat radiation.

N. Degaussing Equipment.

No damage recorded.

O. Gyro Compass Equipment.

No damage occurred.

P. Sound Powered Telephones.

No damage occurred.

Q. Ship's Service Telephones.

Not Applicable.

R. Announcing Systems.

Slight damage occurred from flying objects and shock.

1. One lamp in the bridge transmitter was burned out.

2. The forward speaker on the bridge was made inoperable when cable was torn loose by flying object.

S. Telegraphs.

No damage occurred.

T. Indicating Systems.

No damage occurred.

U. I.C. and A.C.O. Switchboards.

No damage occurred.

V. F.C. Switchboards.

No damage occurred.

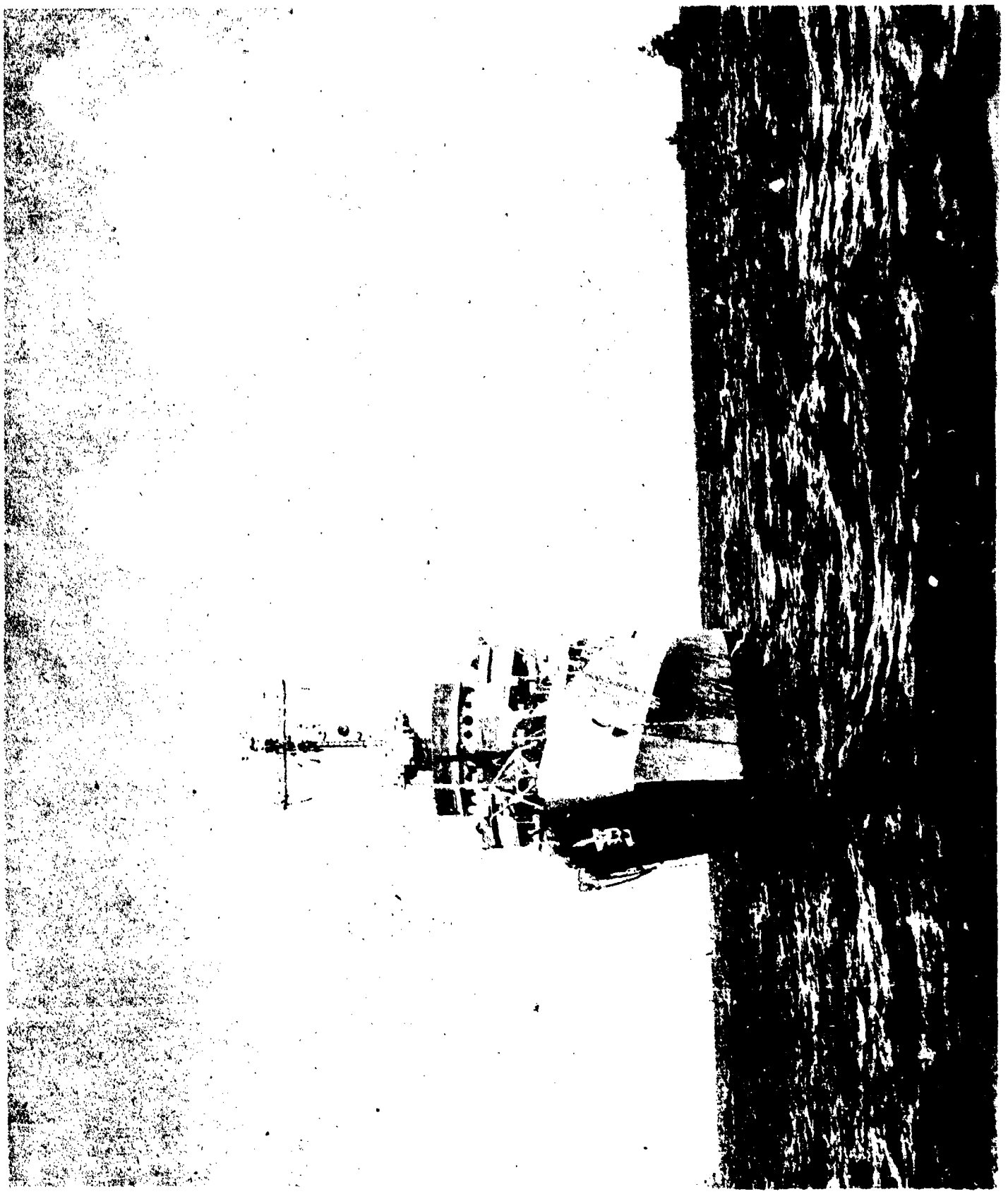
W. Special 660 Material.

No damage occurred except the cable around pilot house was scorched slightly from radiant heat. This cable was not painted.

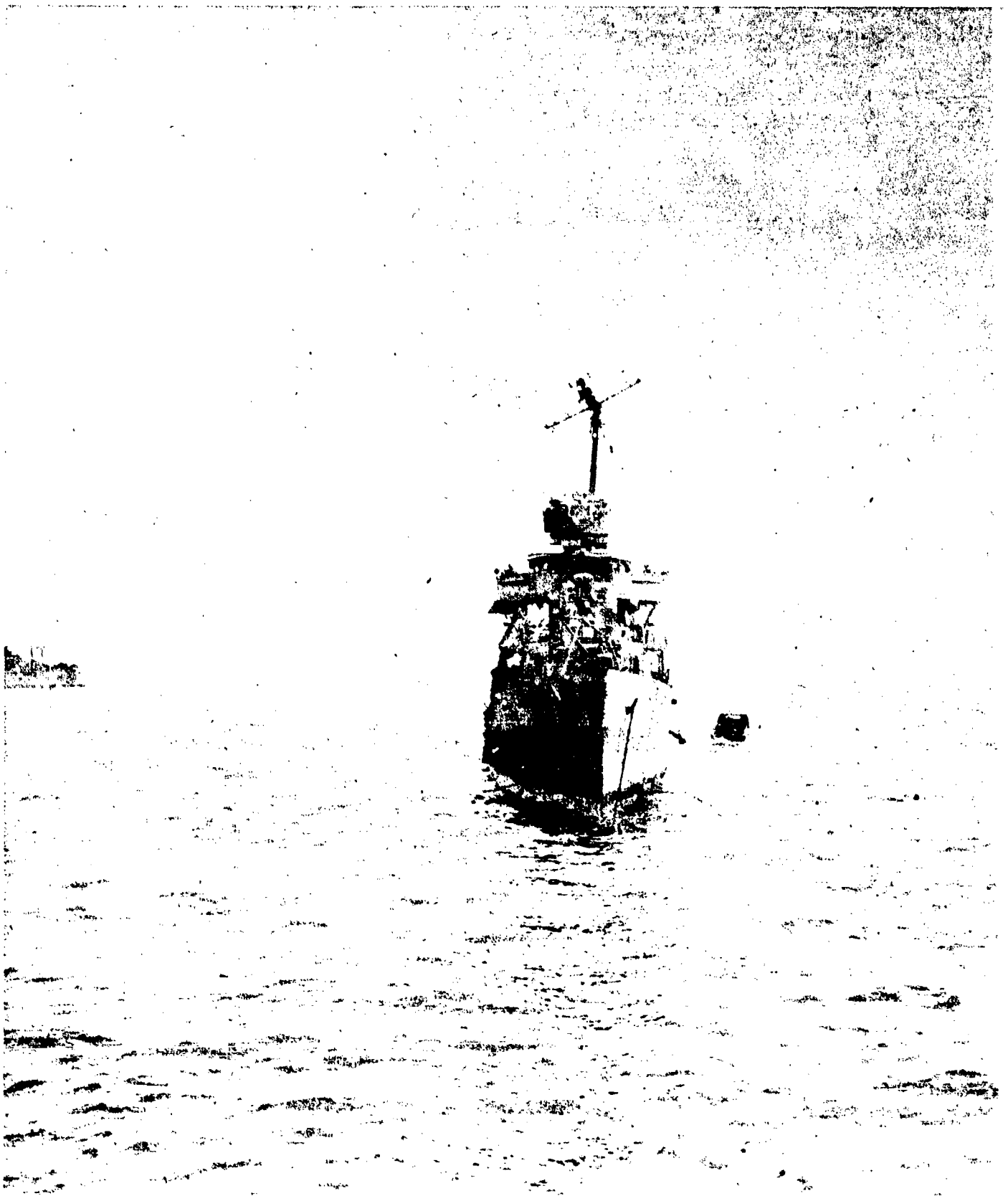
SECTION IV

PHOTOGRAPHS

TEST ABLE

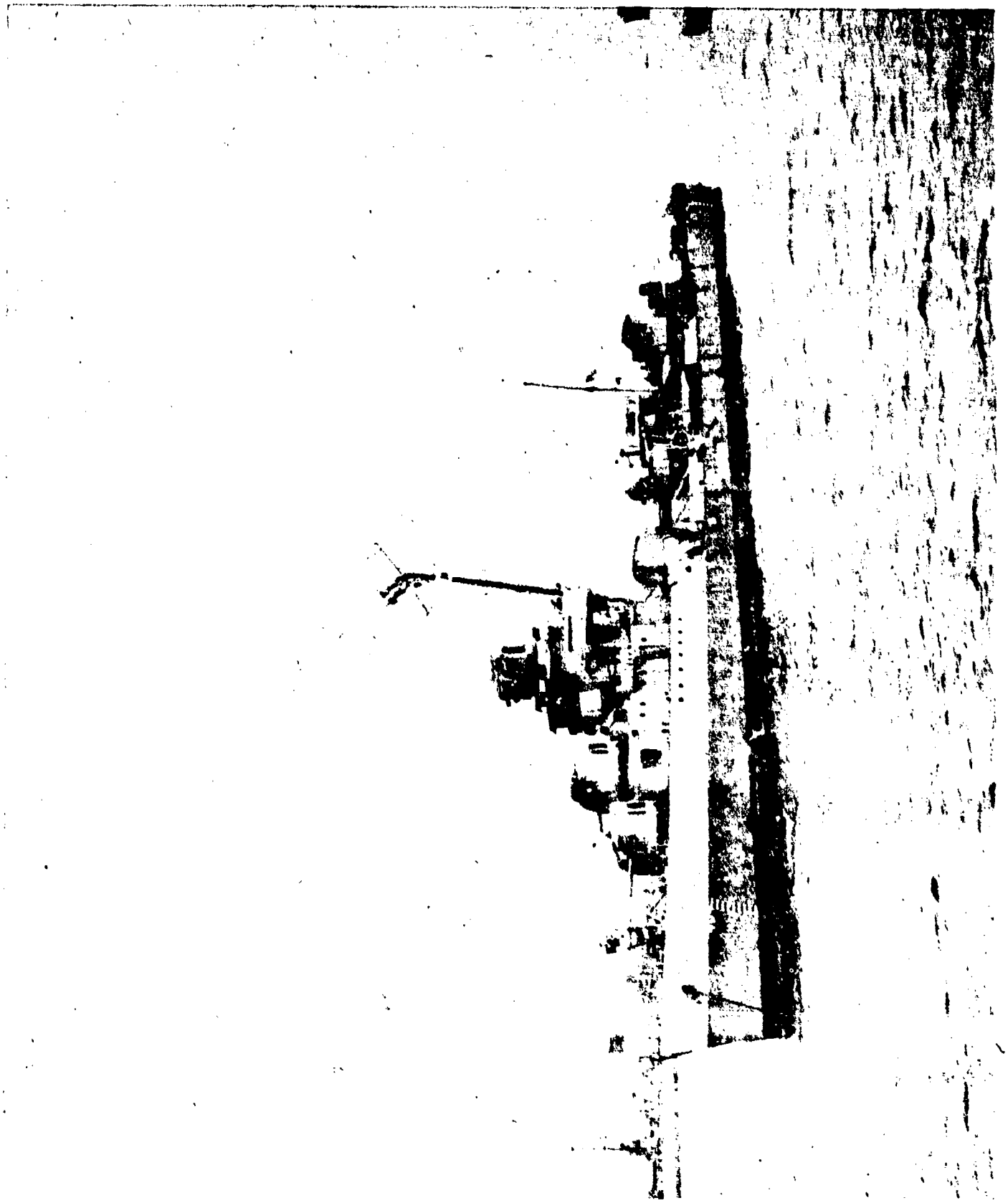


BA-CR-196-156-2. View from dead ahead before Test A.

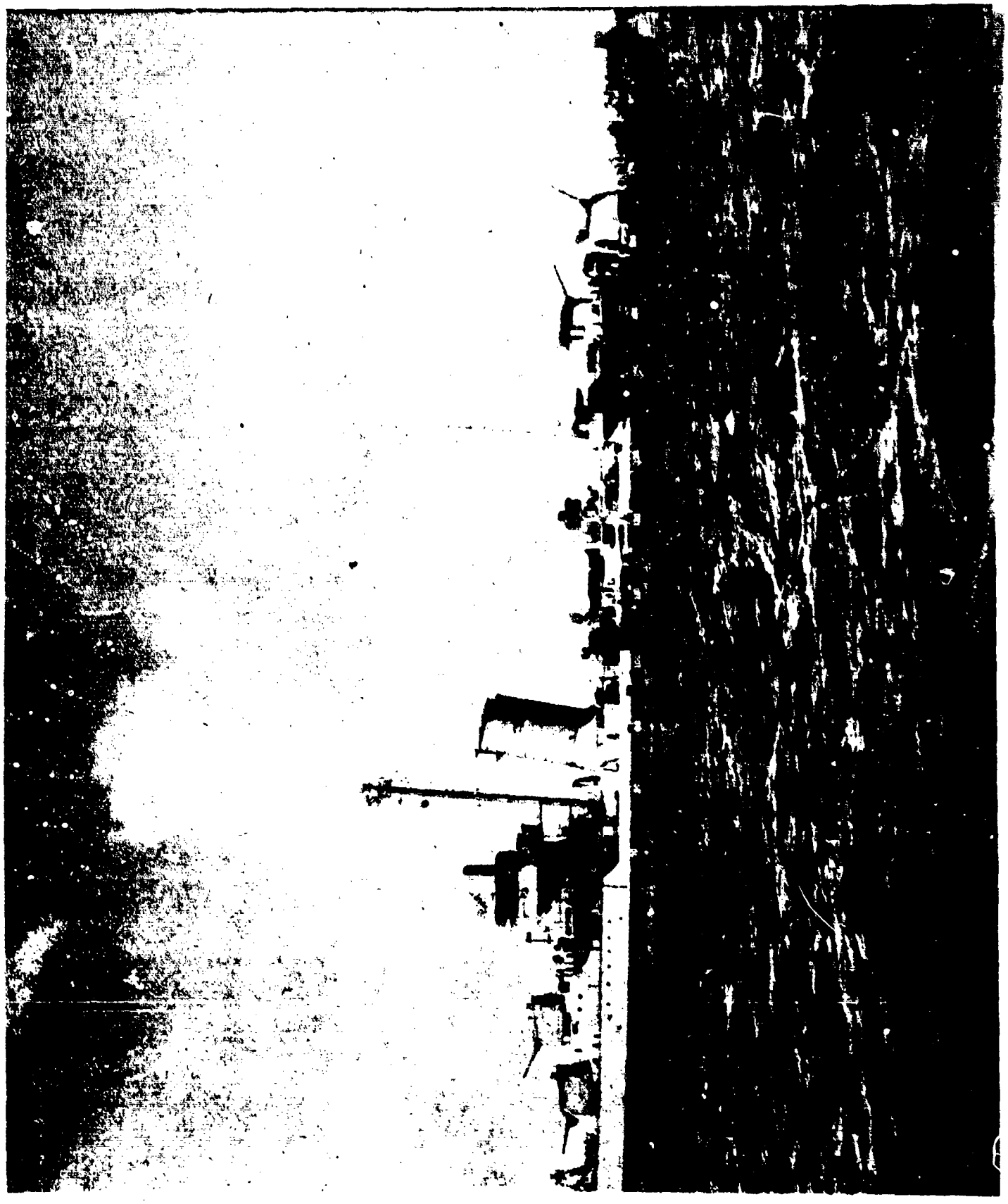


AA-CR-227-49-136. View from dead ahead after Test A.

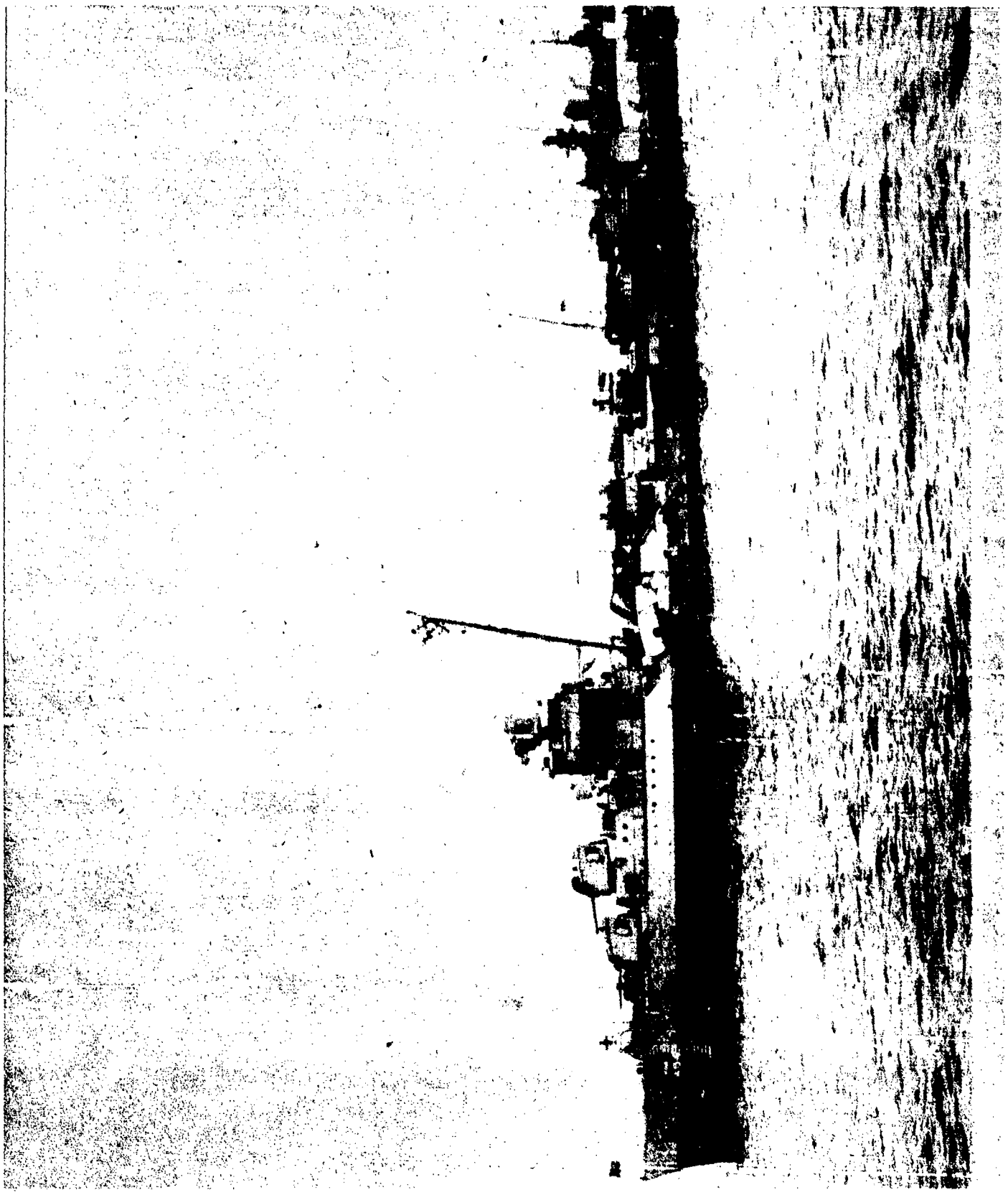
BA-CR-196-156-1. View from off port bow before Test A.



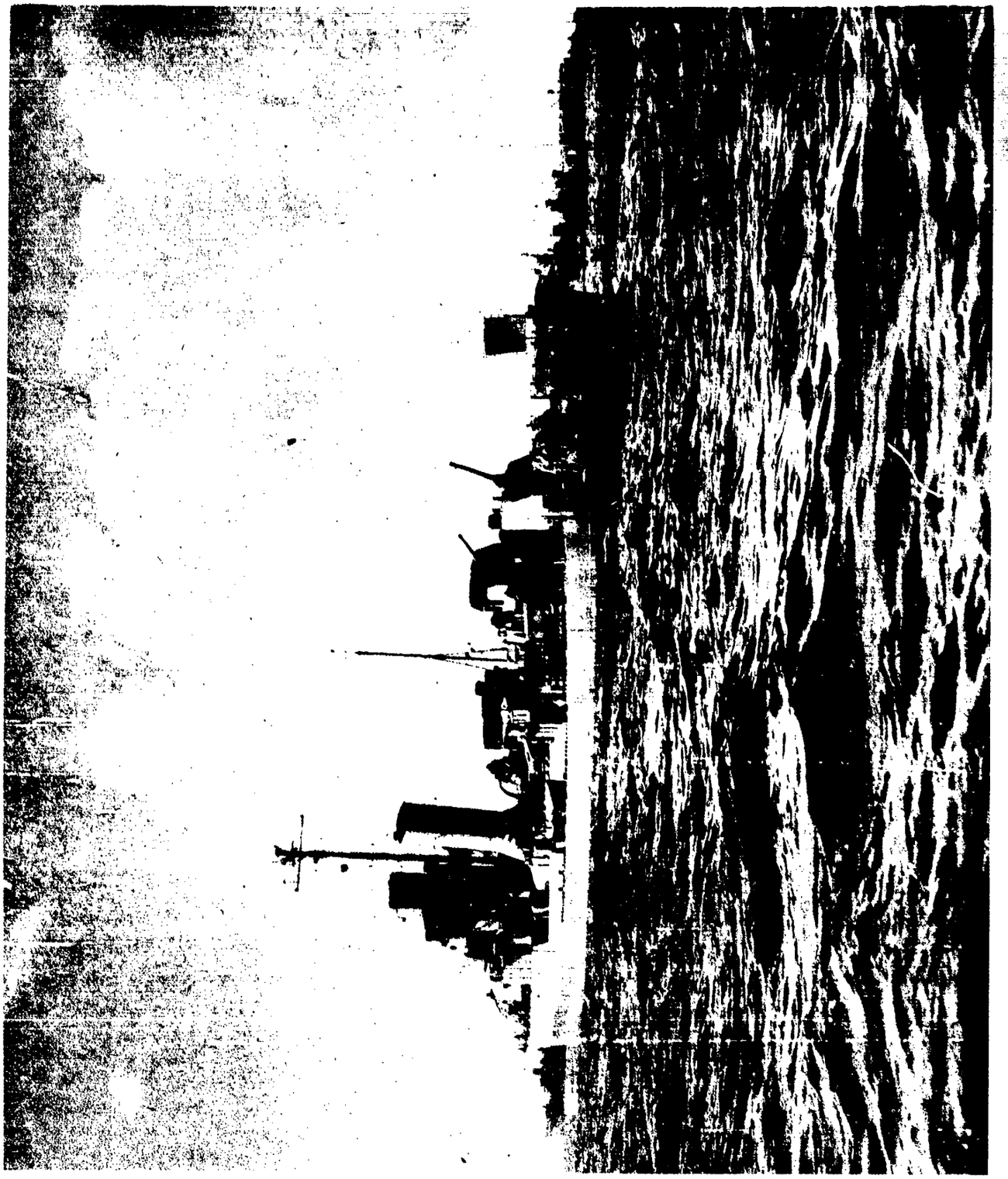
AA-CR-227-49-137. View from off port bow after Test A.



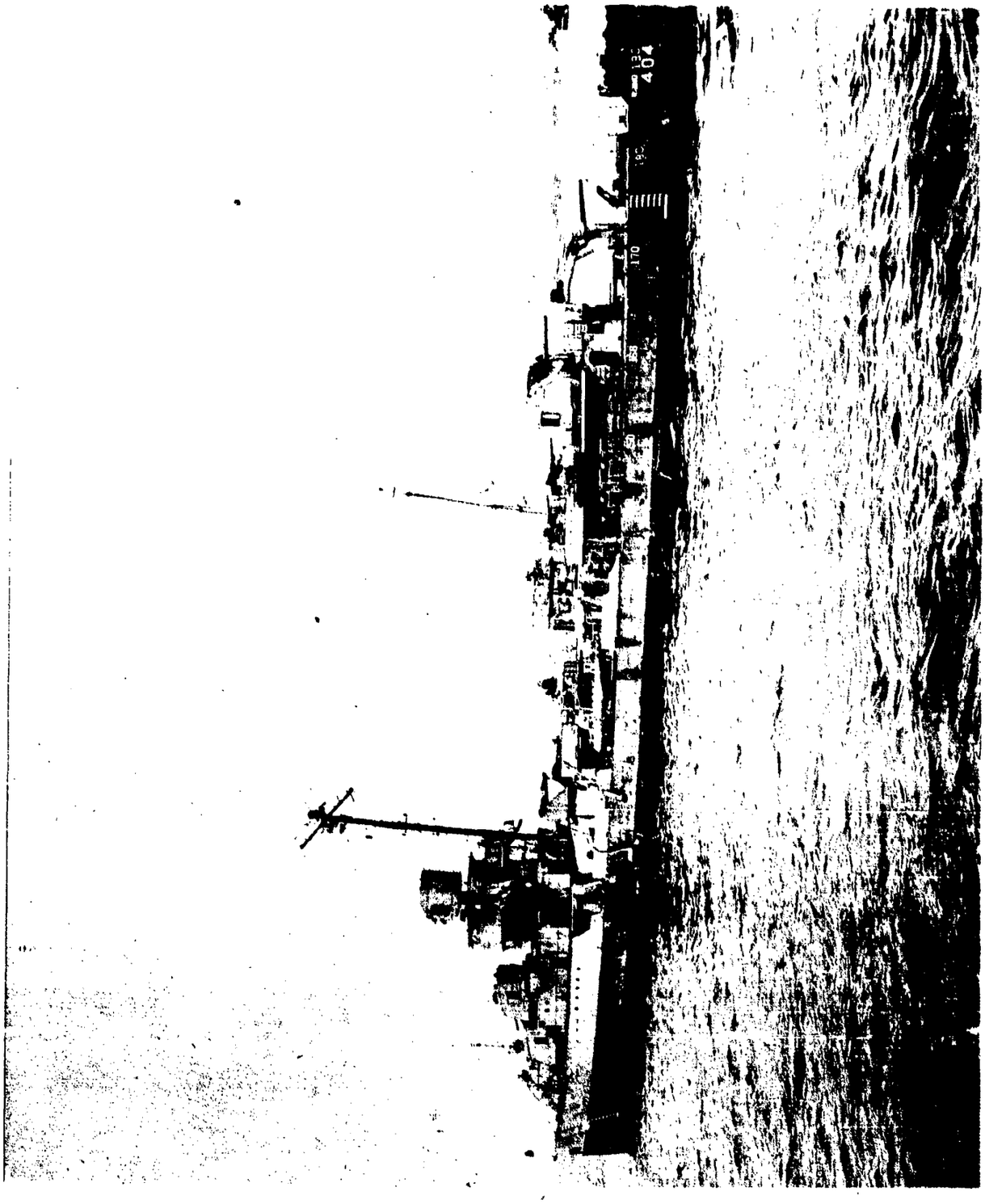
BA-CR-196-156-8. **View from off port beam** before Test A.



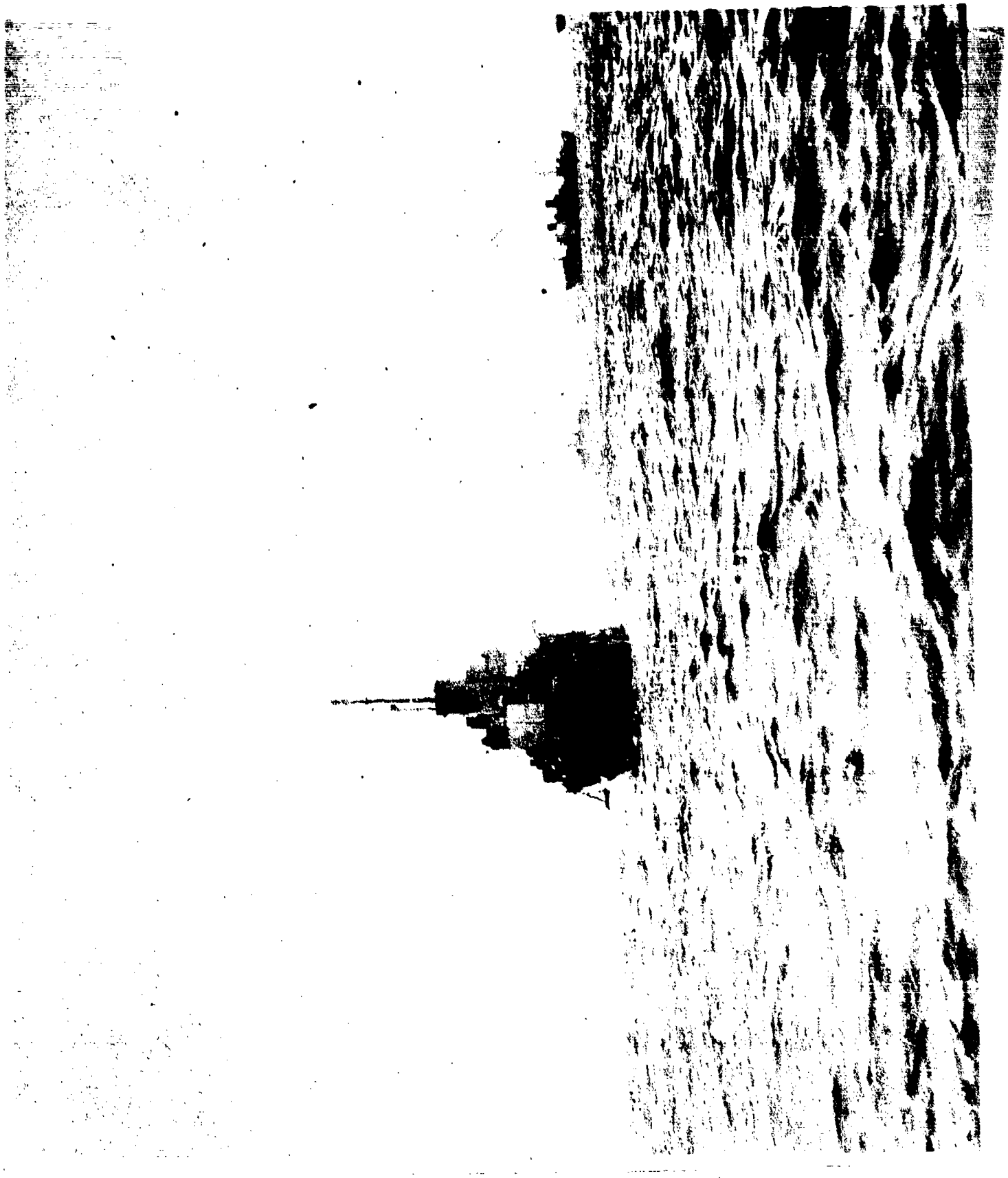
AA-CR-227-49-138. View from off port beam after Test A.



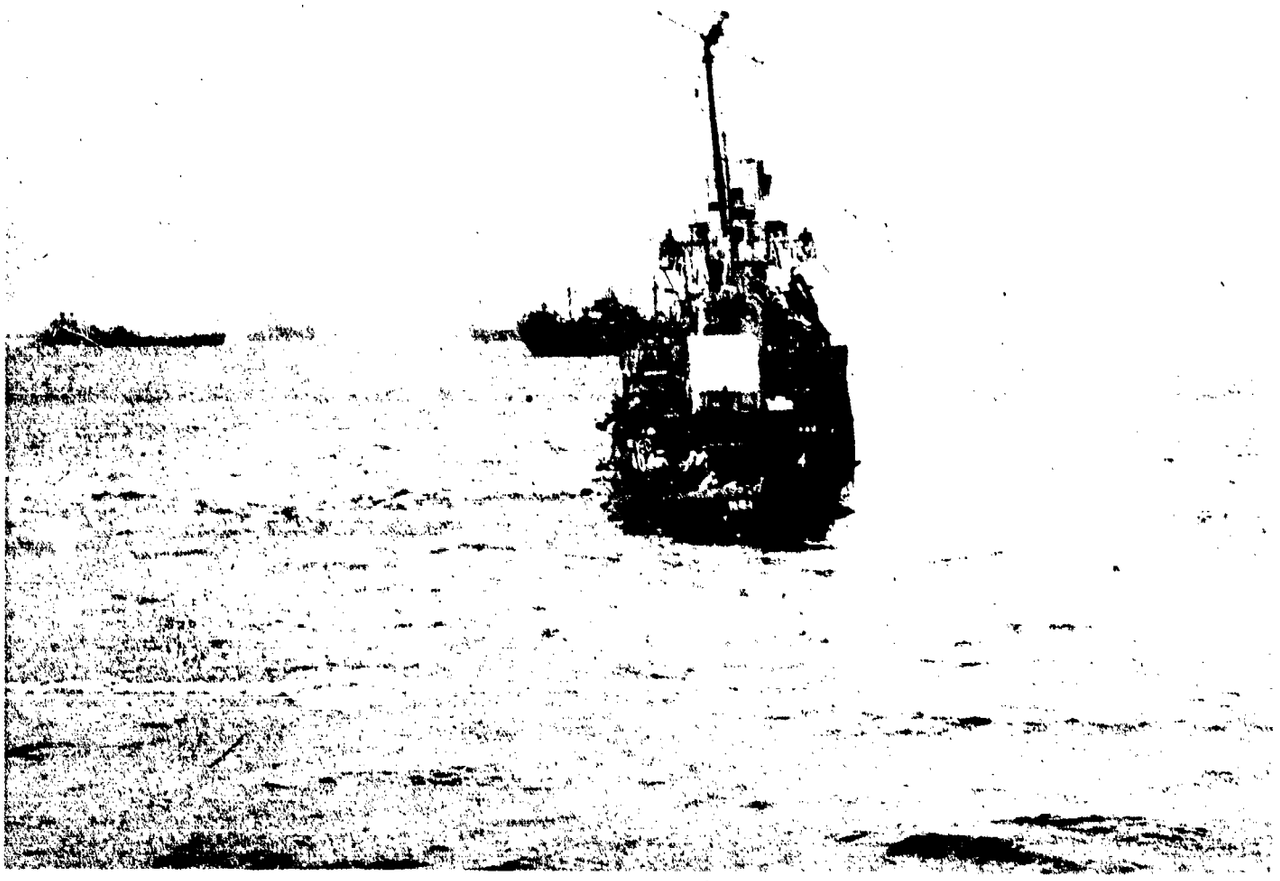
BA-CR-196-156-7. View from off port quarter before Test A.



AA-CR-227-49-139. View from off port quarter after Test A.



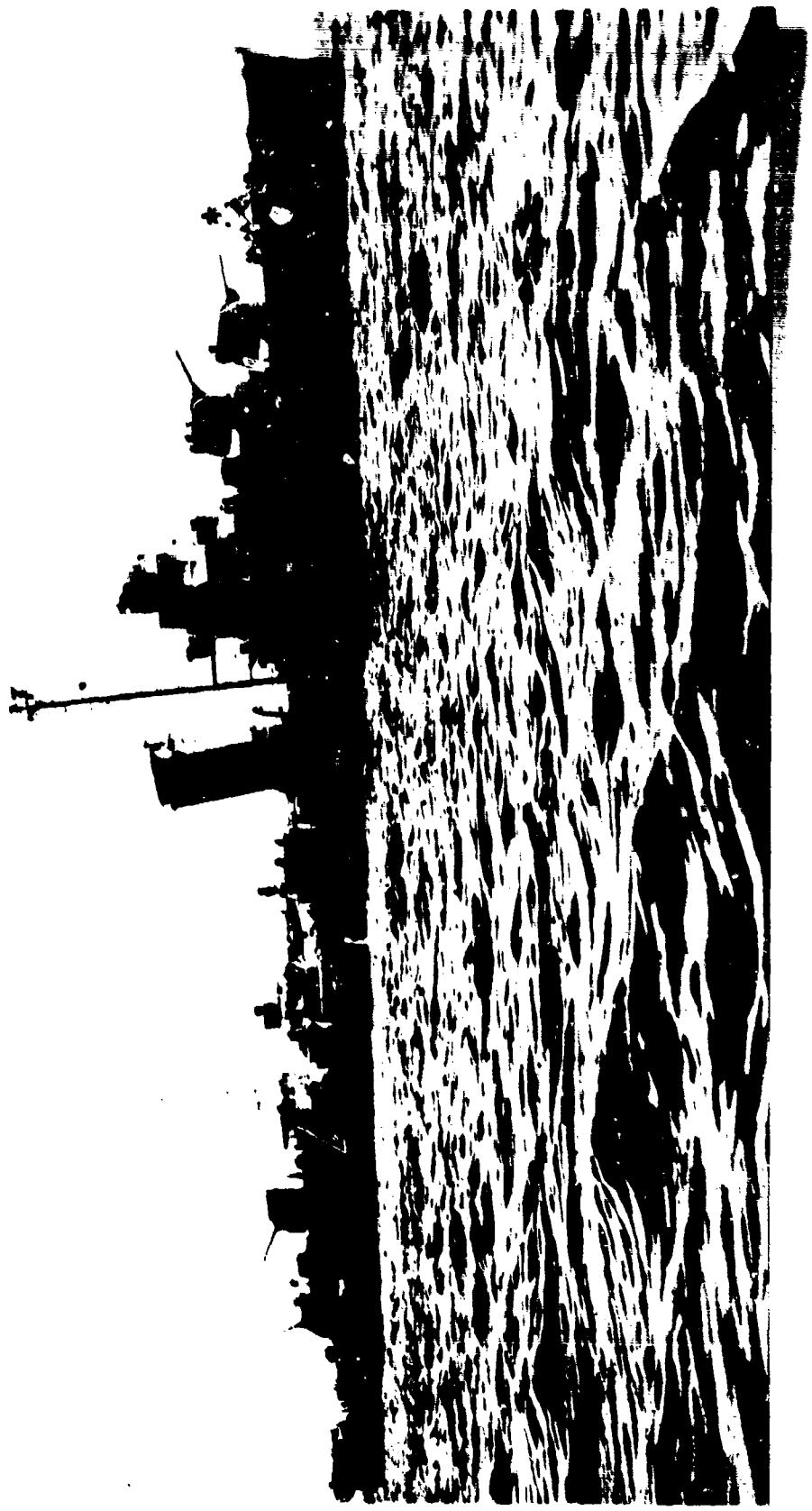
BA-CR-196-156-6. View from astern before Test A.



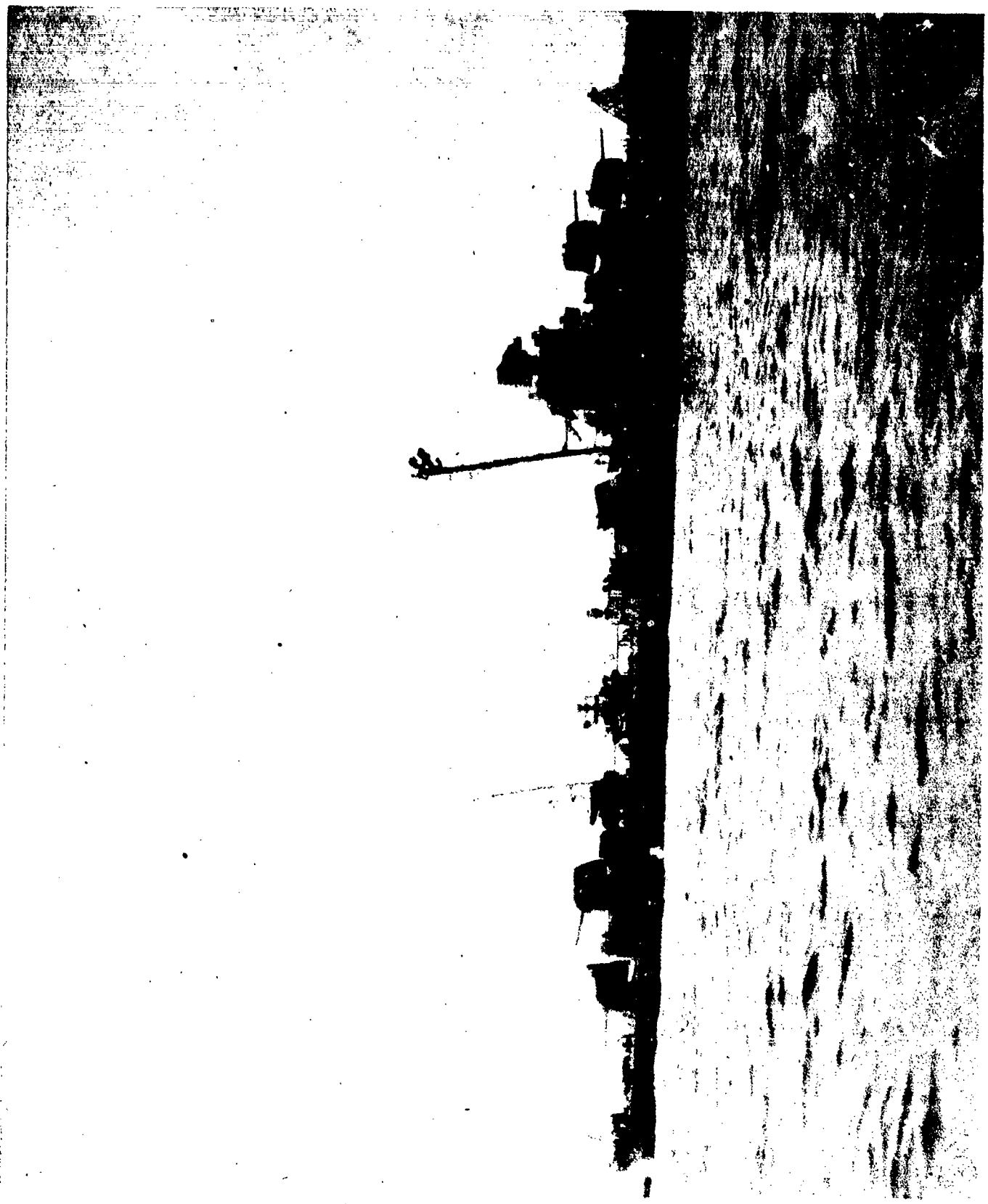
AA-CR-227-49-140. View from astern after Test A.

BA-CR-196-156-5. View from off starboard quarter before Test A.

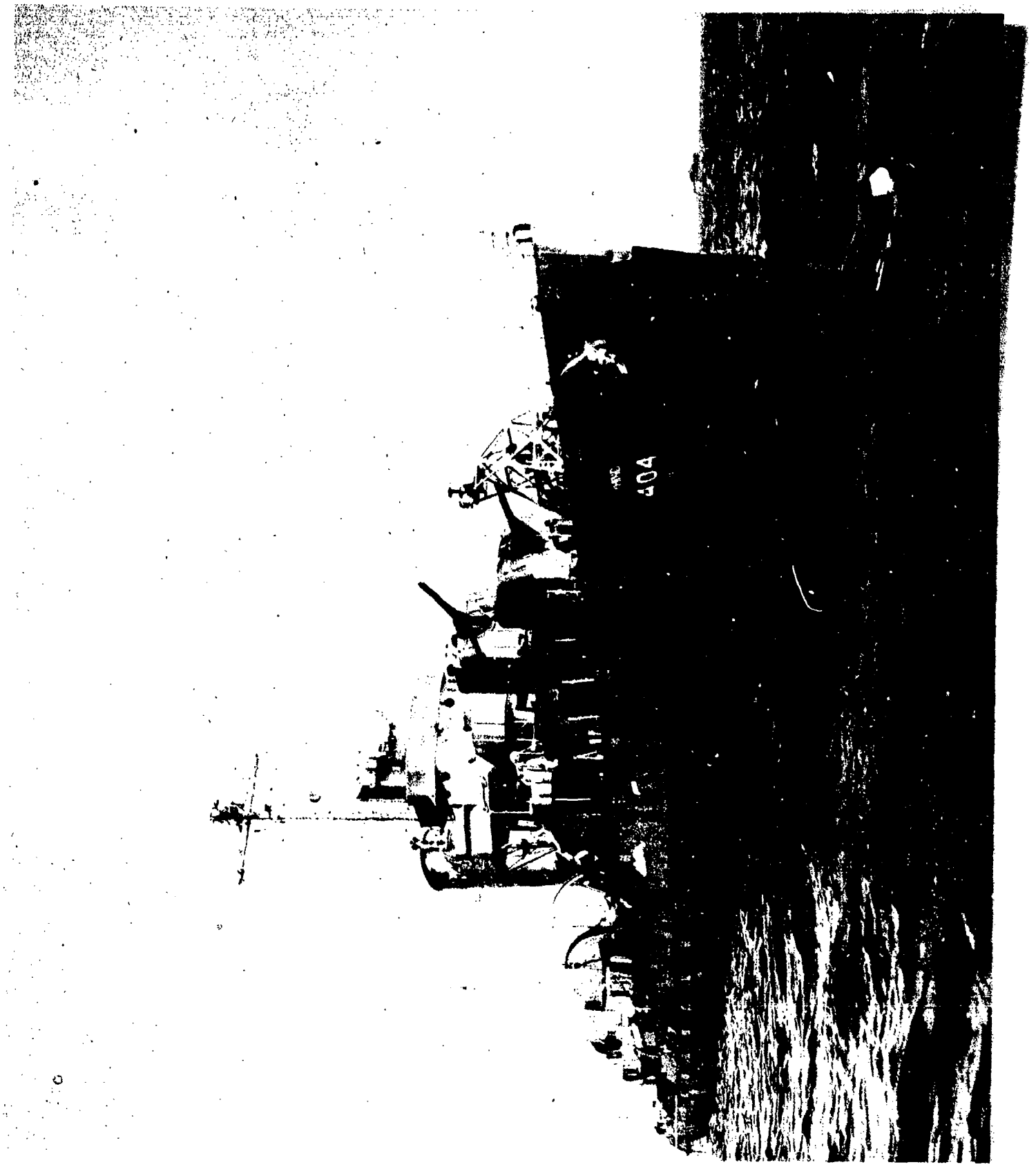
AA-CR-227-49-134. View from off starboard quarter after Test A.



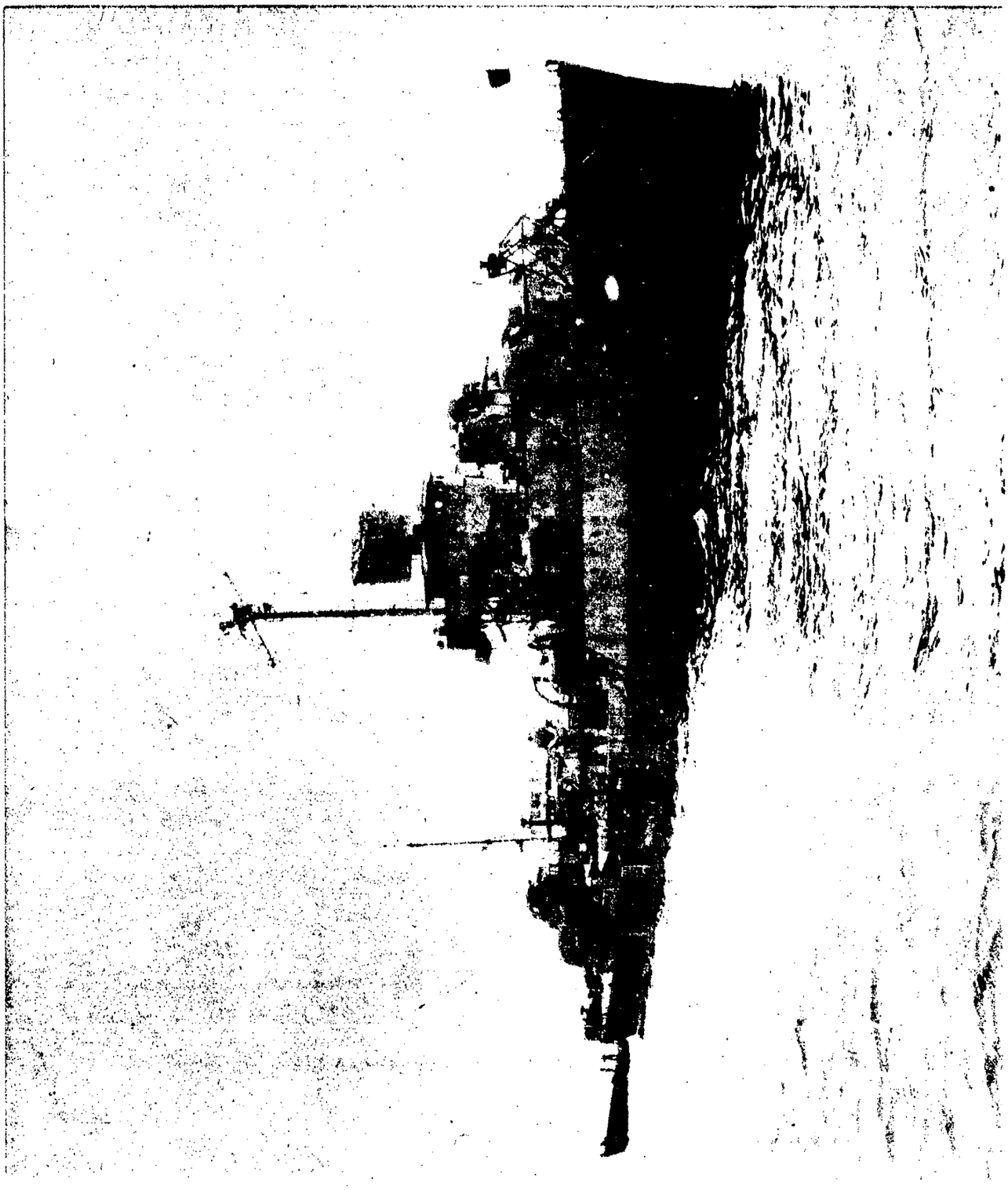
BA-CR-196-156-4. View from off starboard beam before Test A.



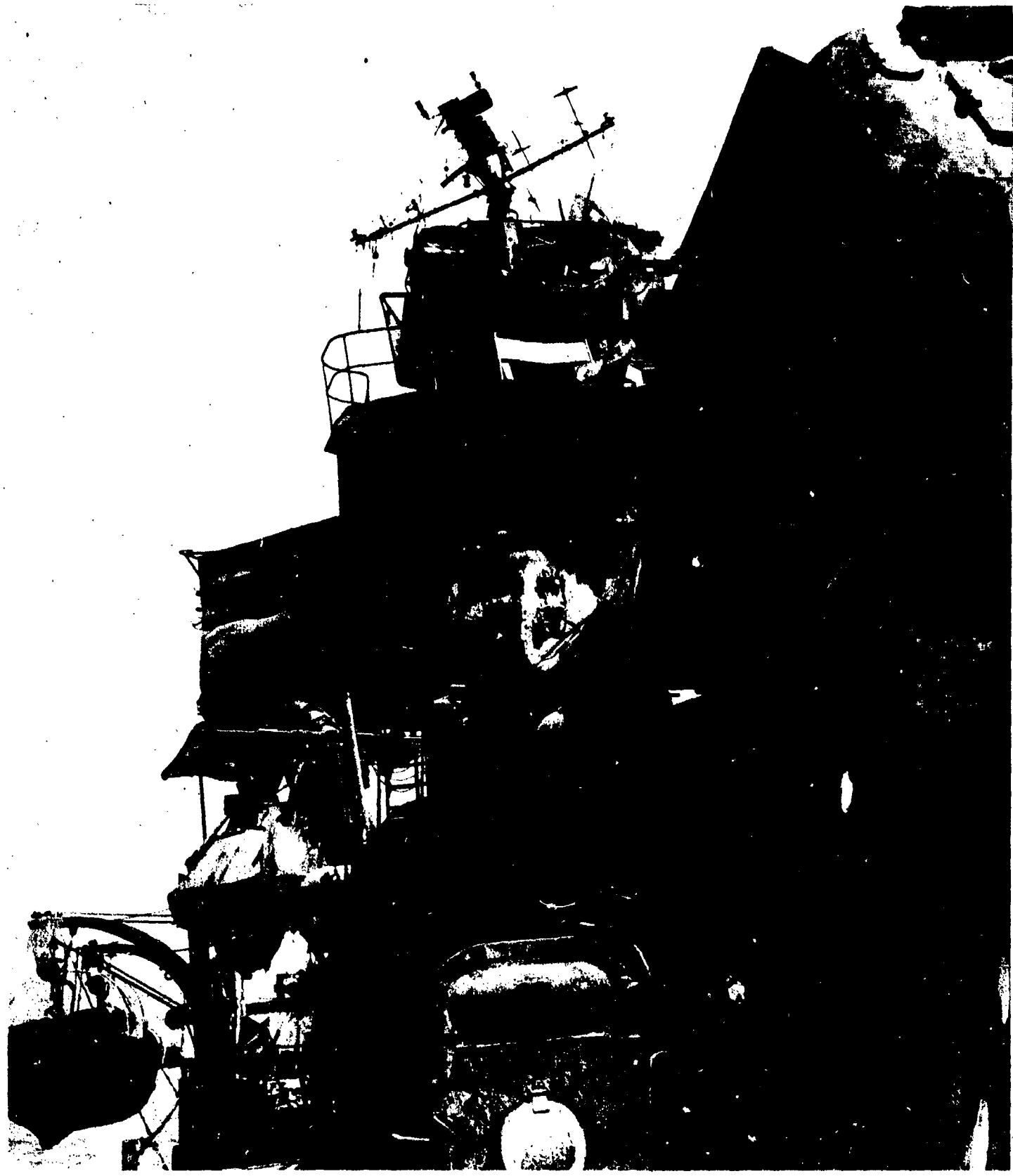
AA-CR-227-92-107. View from off starboard beam after Test A.



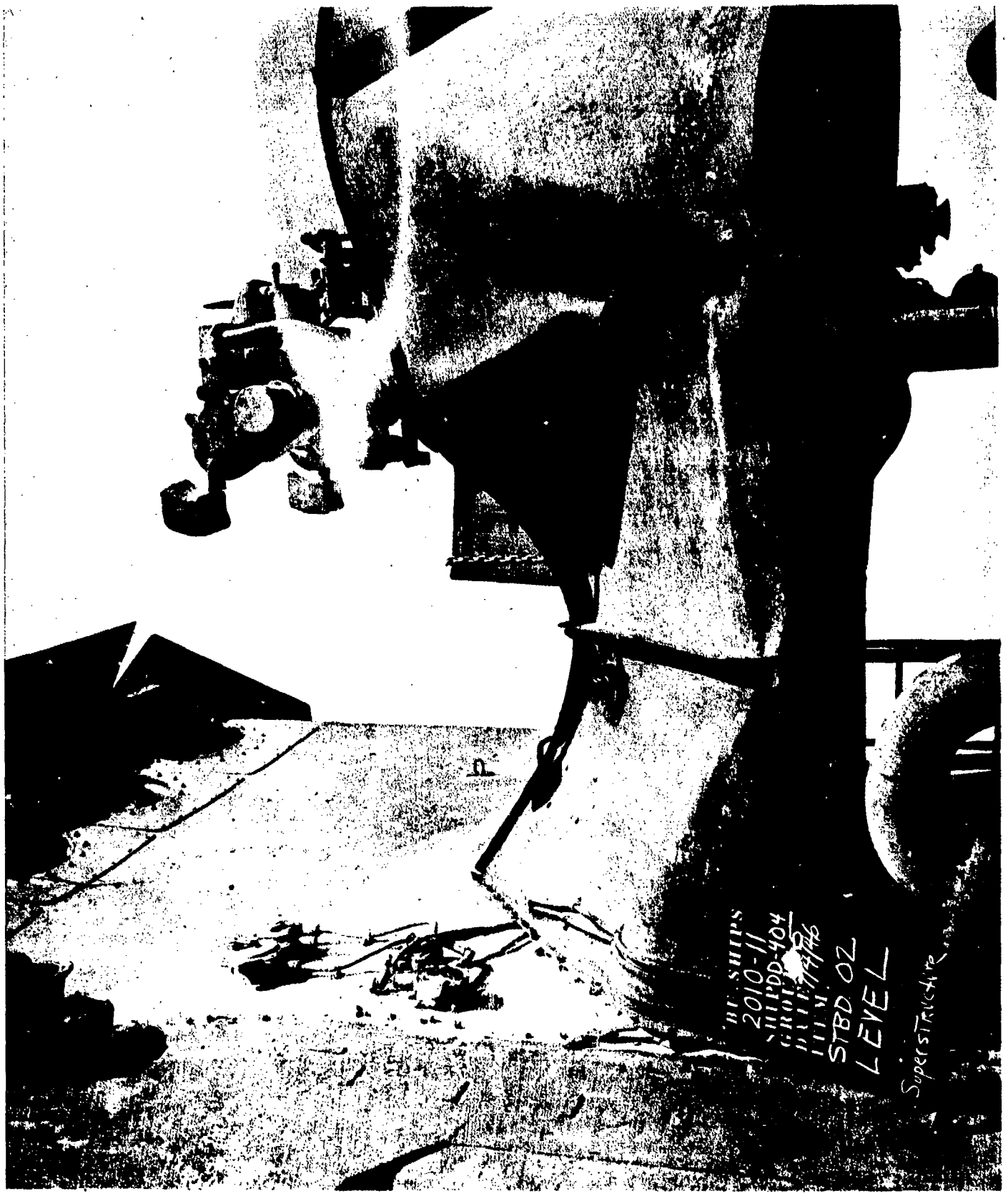
BA-CR-196-156-3. View from off starboard bow before Test A.



AA-CR-227-49-135. View from off starboard bow after Test A.

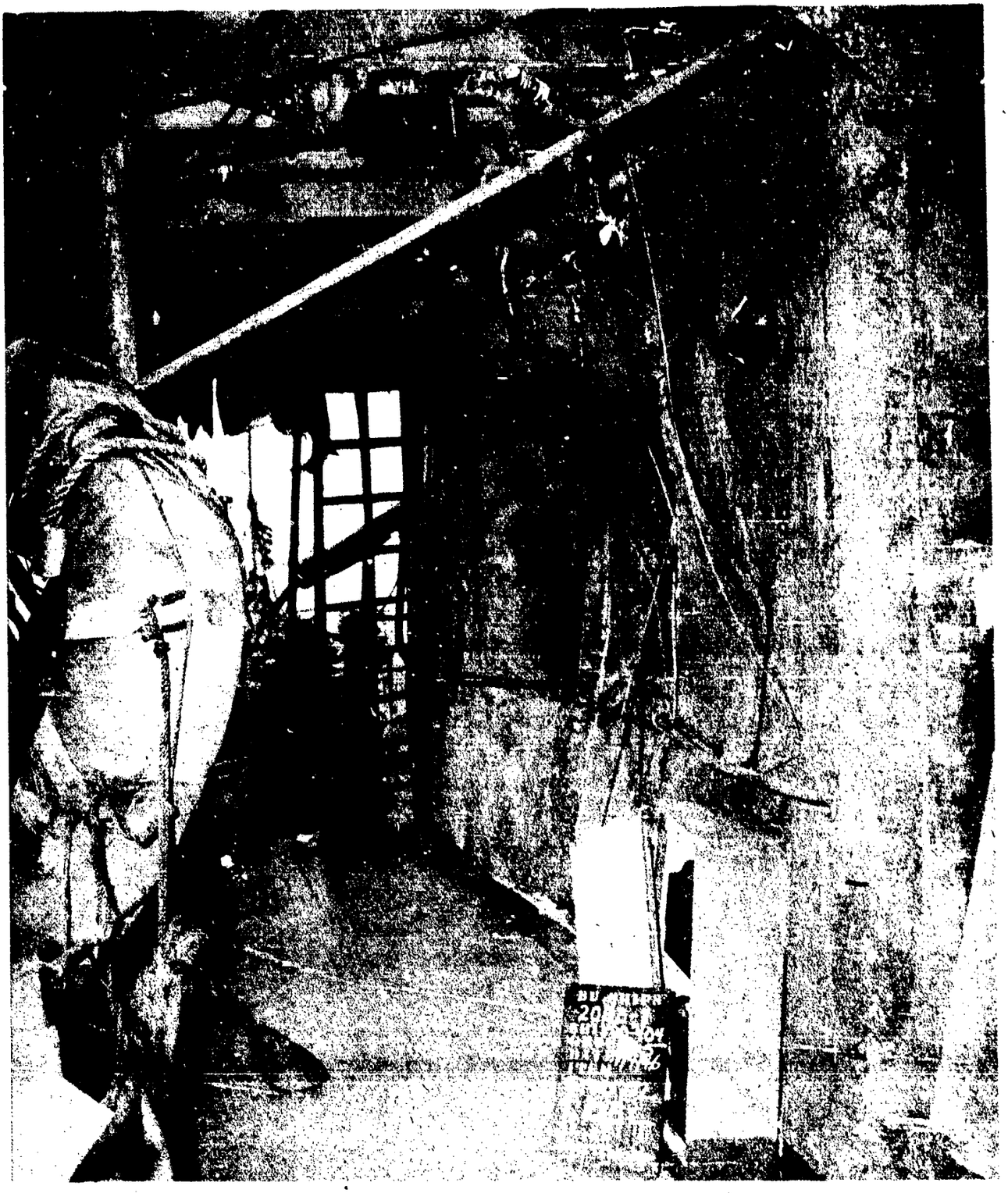


AA-CR-58-2005-5. General view of damage looking aft along the starboard forecastle deck.



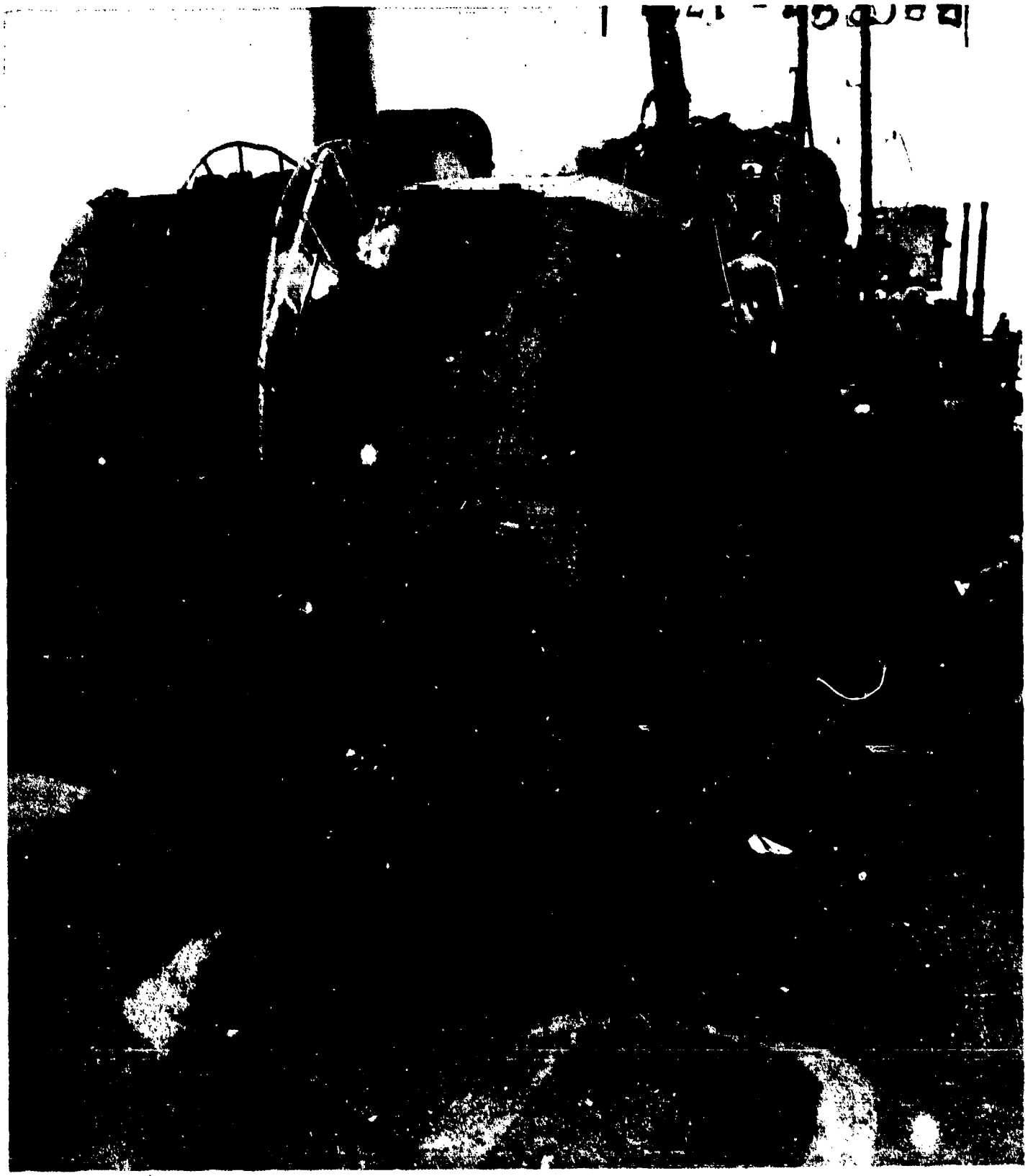
AA-CR-58-2010-11. View looking athwartship in front of bridge, 02 level. Showing damage director shield and scorched paint on house.

AA-CR-92-1772-1. View looking aft showing damage in navigating bridge area.

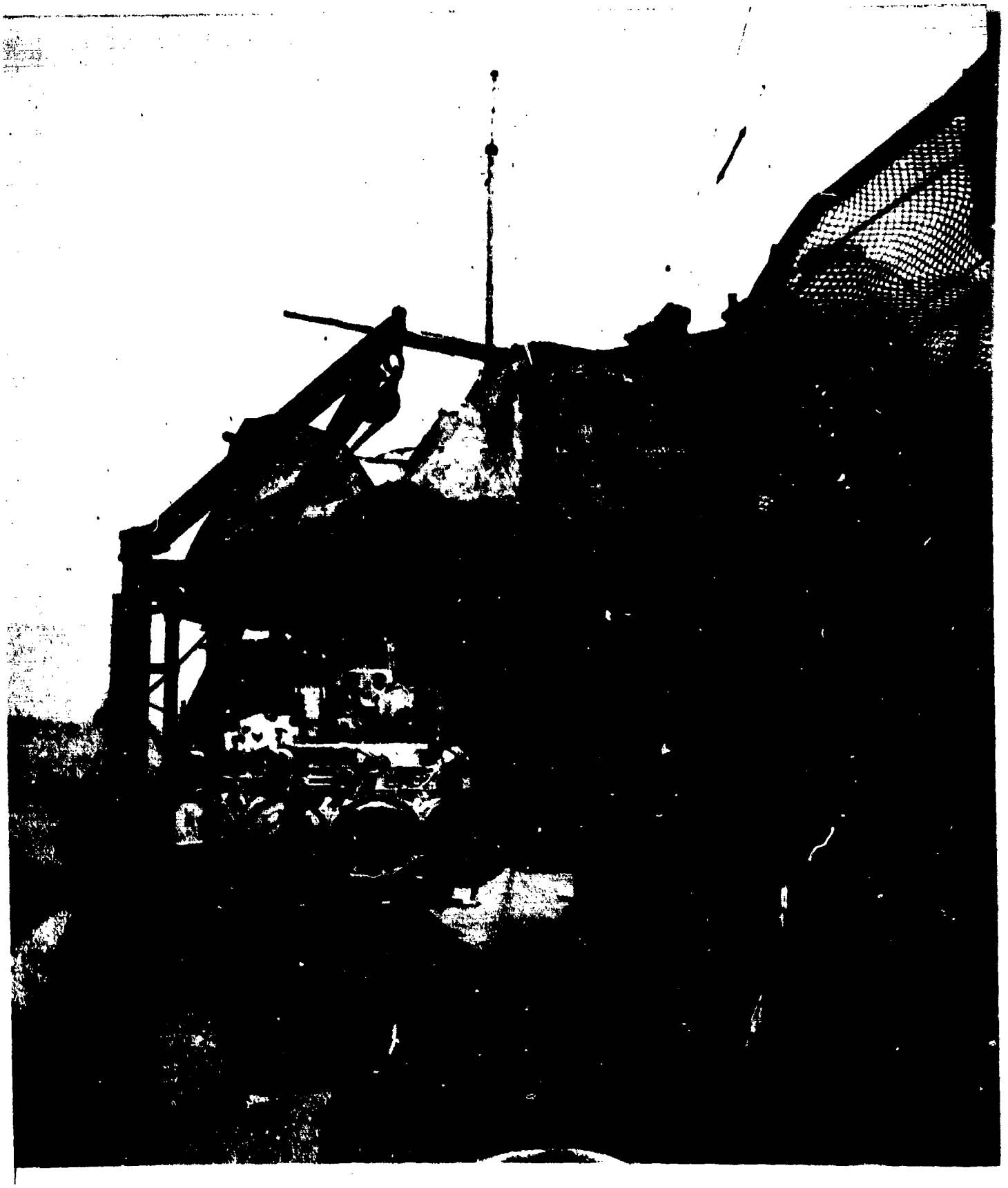


AA-CR-58-2003-1. View of starboard side of 02 level deck house looking aft showing ruptured bulkhead in way of CIC room door.

AA-CR-65-1817-4. View showing ruptured aluminum bulkhead in way of CIC door.



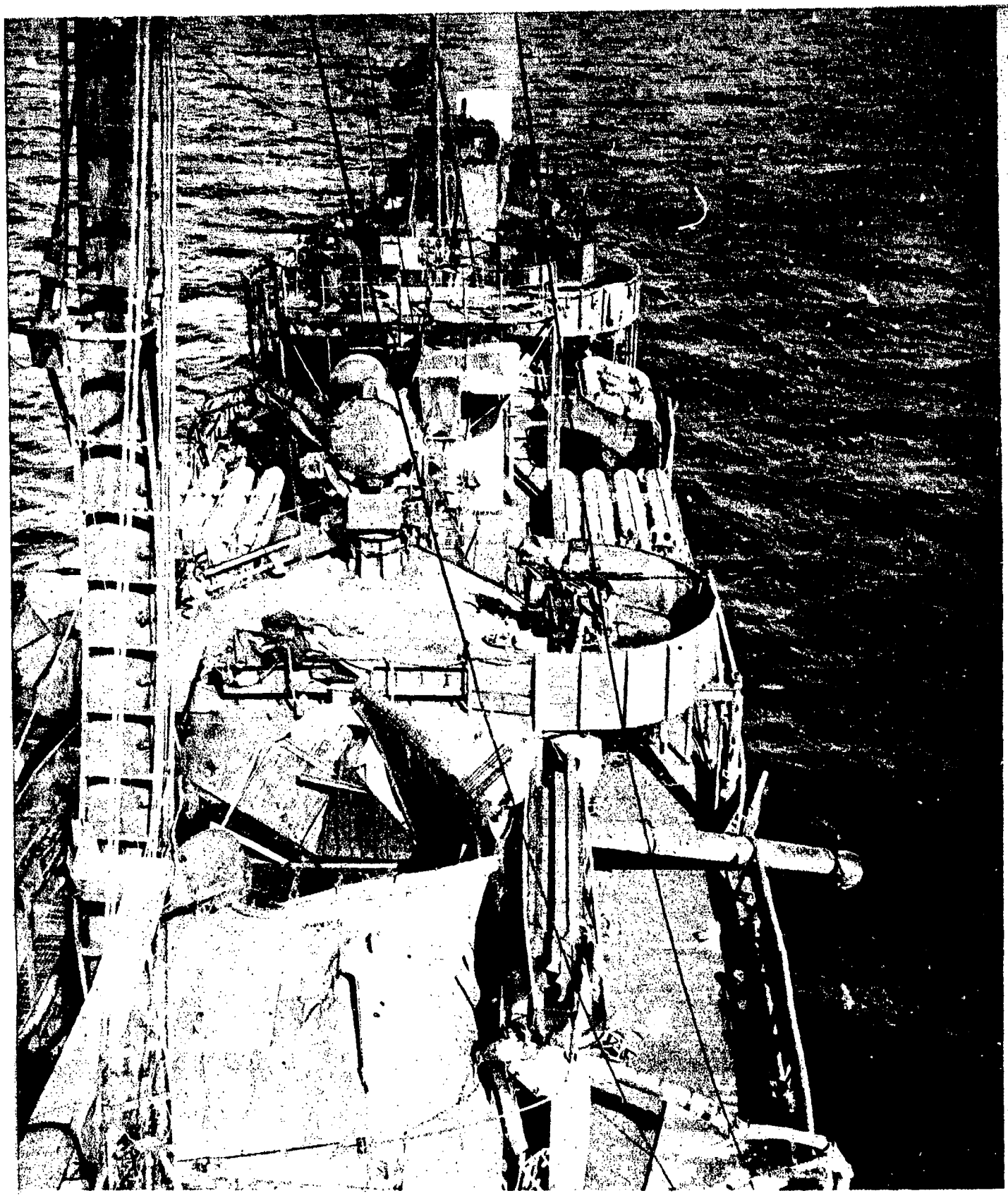
AA-CR-92-1771-11. View of superstructure damage looking from stern along starboard side showing burned bloomer on #4 5" gun.



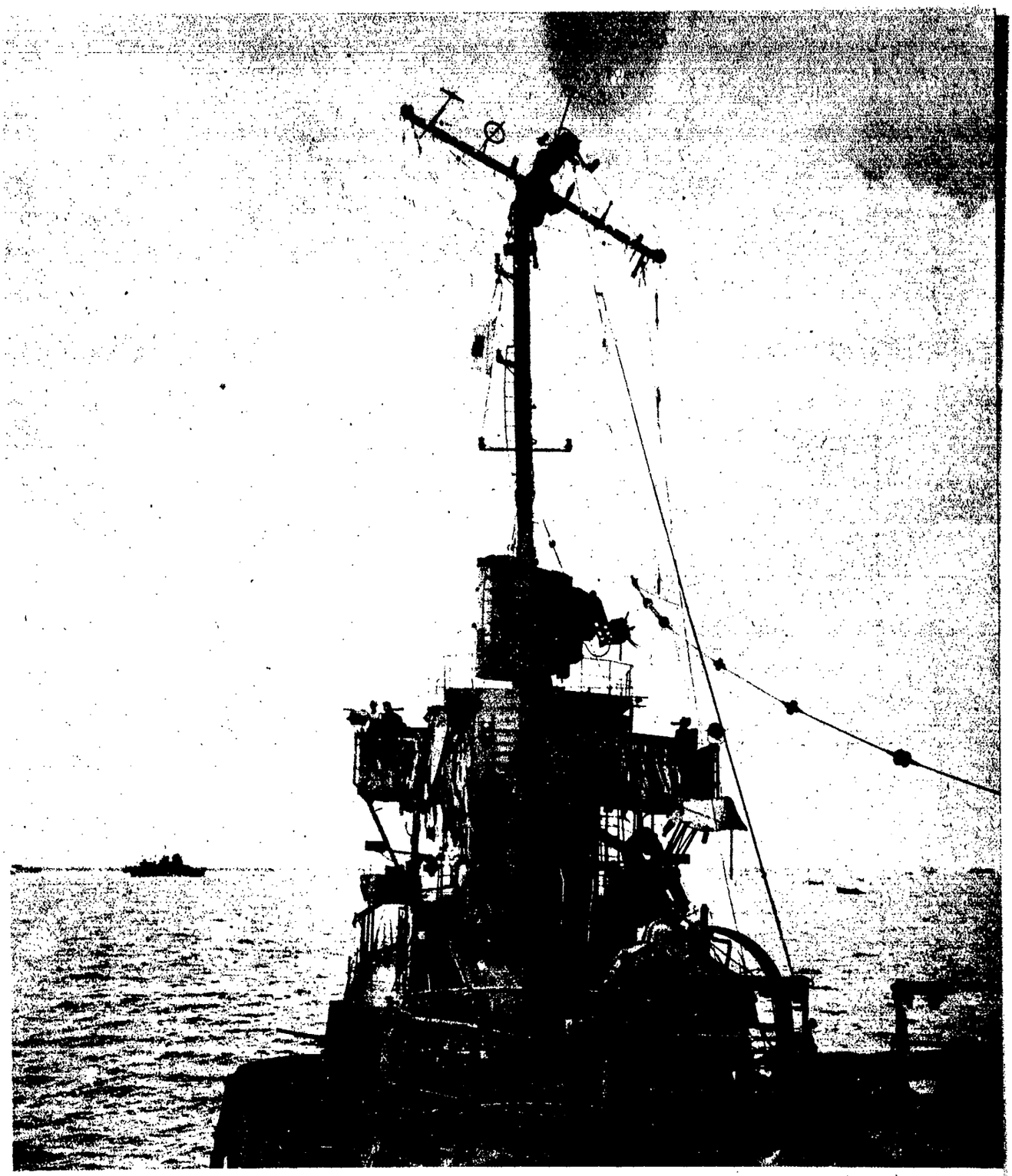
AA-CR-58-2005-3. View of midship deck house starboard side, looking aft, showing damaged 20MM gun tub, life raft nets, bulwark and doors.

AA-CR-58-2010-10. View from 02 level aft showing damaged 20MM gun shield on 01 level.

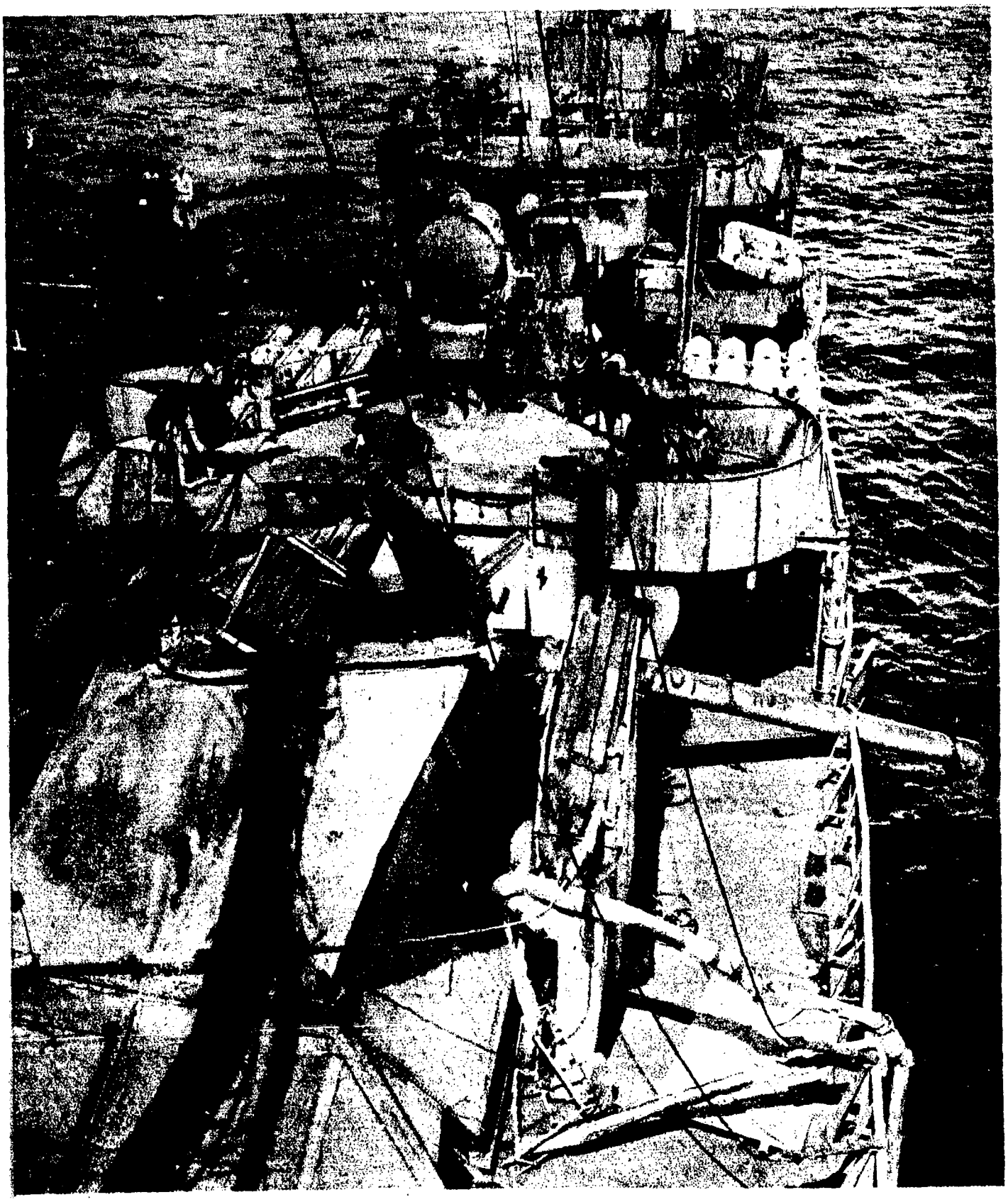
AA-CR-53-2010-8. General view of damage looking aft the length of the ship from the starboard side of the navigating bridge.



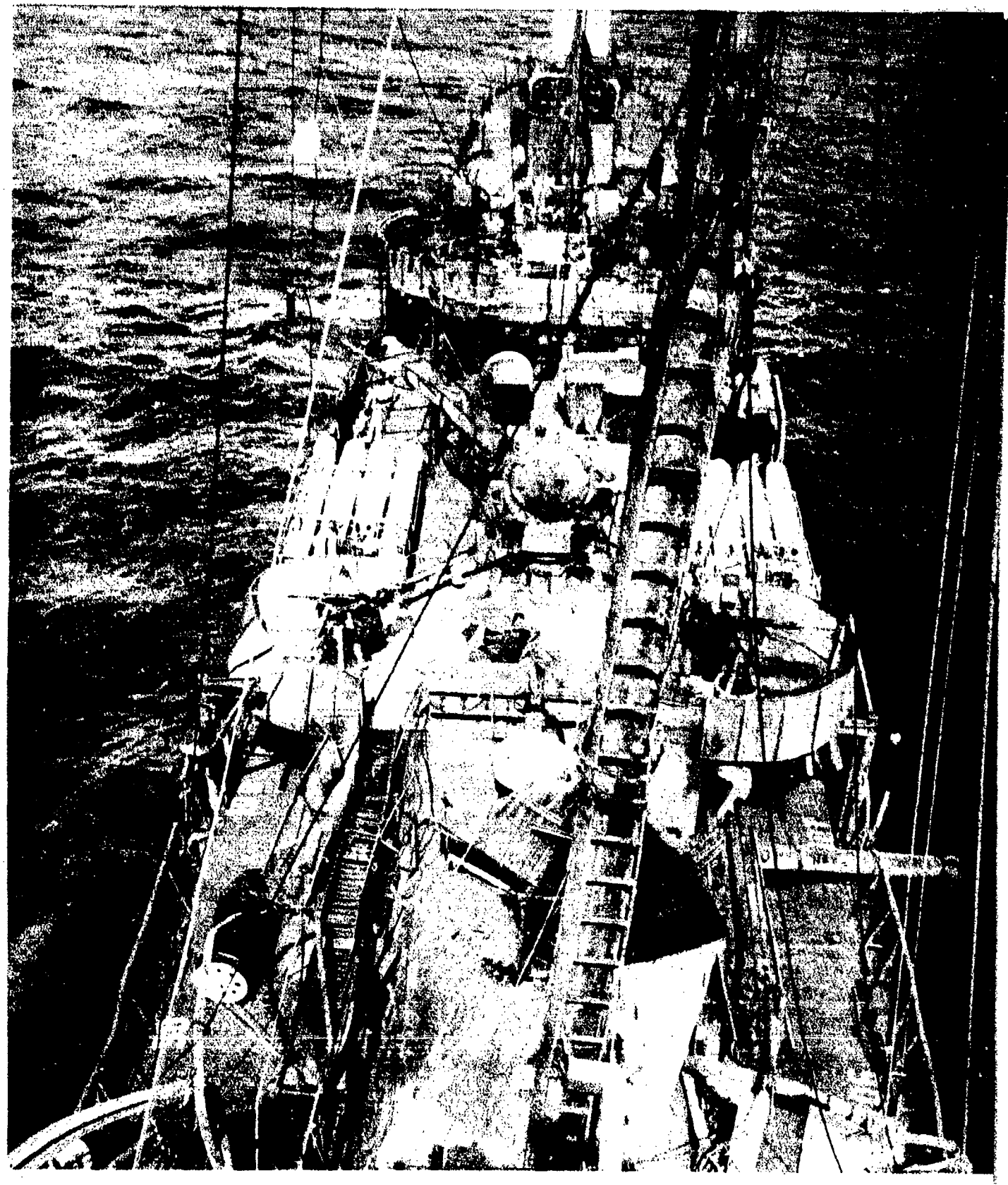
AA-CR-58-2010-9. General view of damage looking aft the length of the ship from the port side of the navigating bridge.



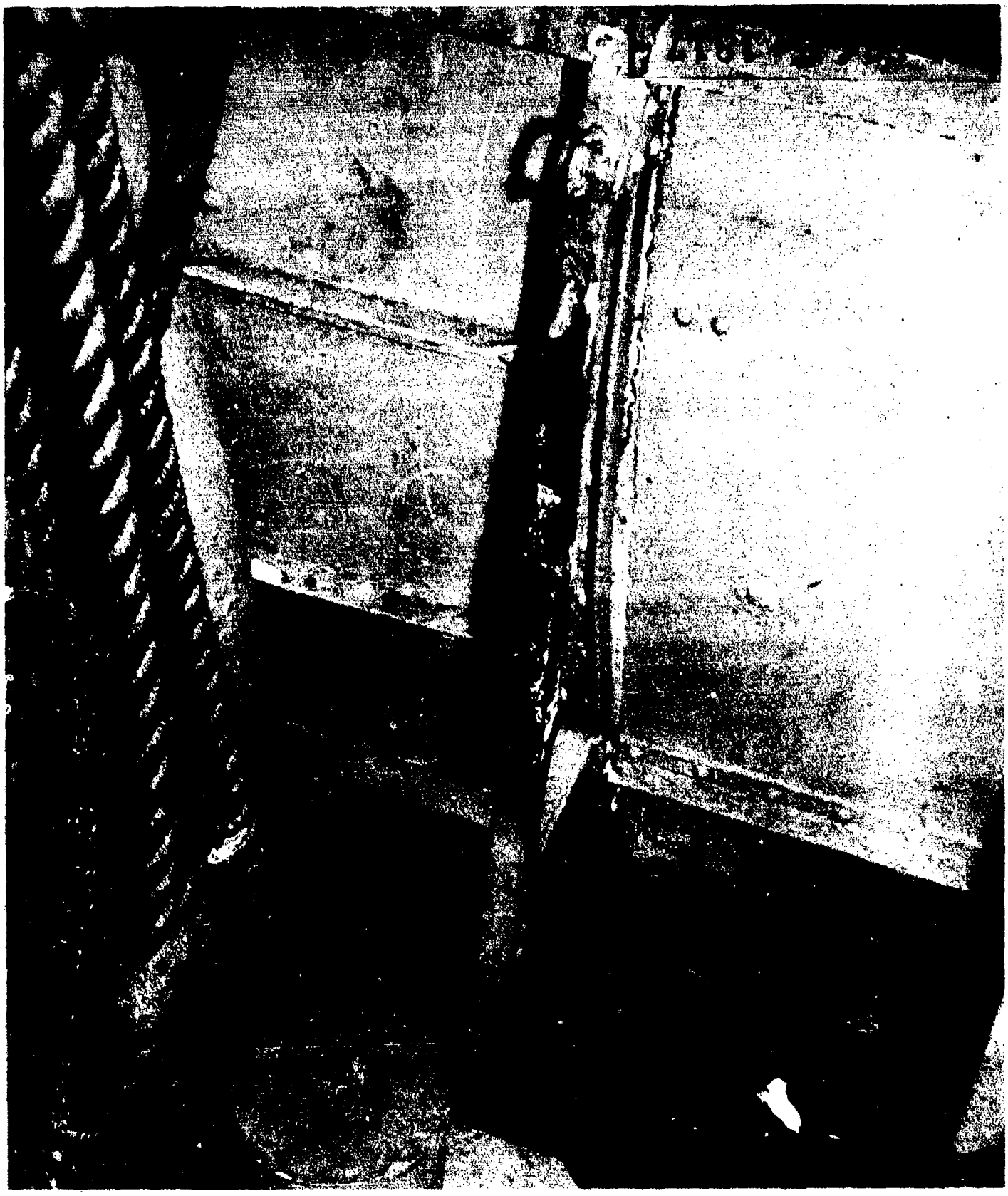
AA-CR-58-2003-11. View looking forward from after deck house showing damage amidships.



AA-CR-58-2003-10. View looking aft from port side of navigation bridge.

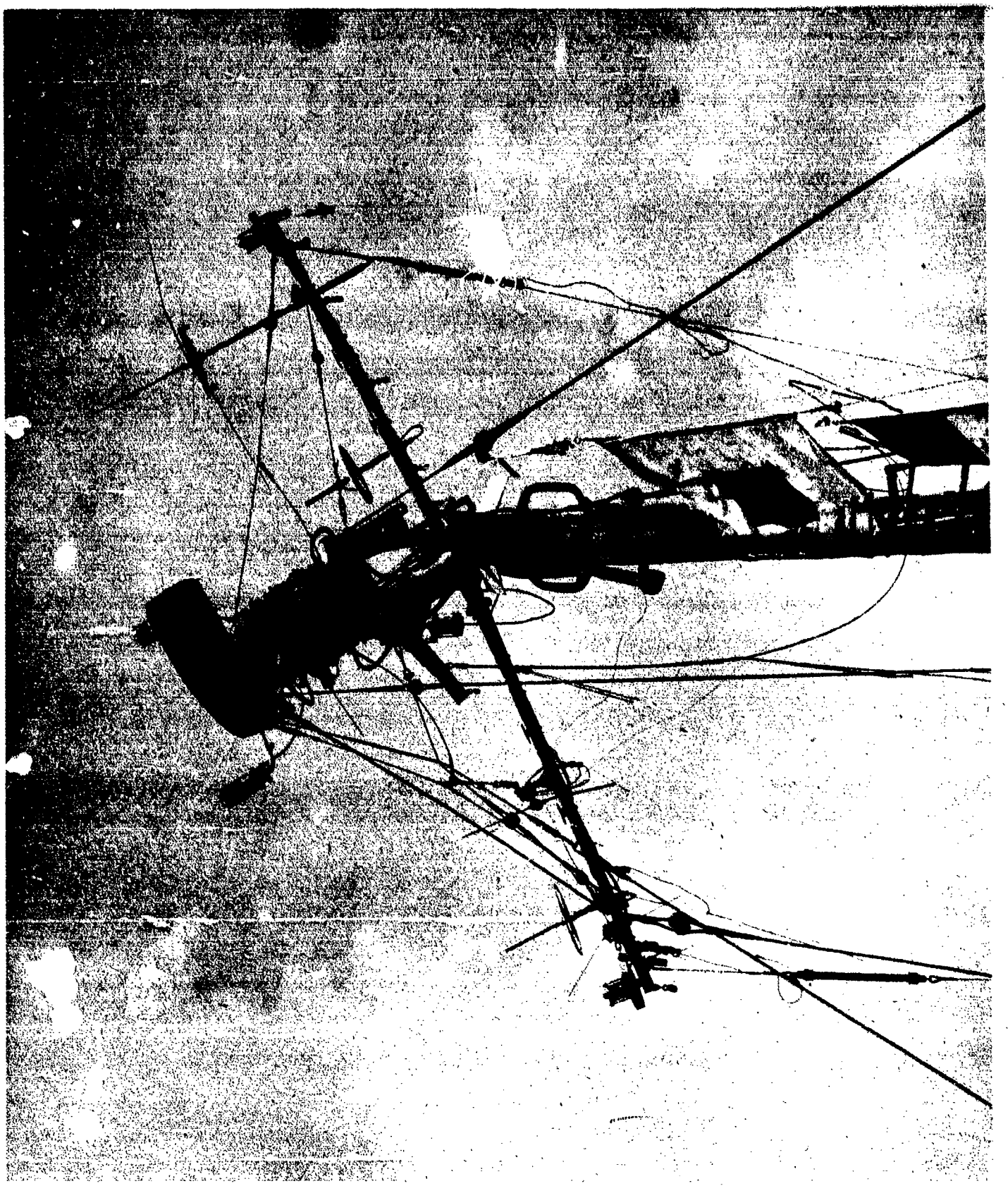


AA-CR-58-2003-2. View looking aft the length of the ship from sky lookout forward.

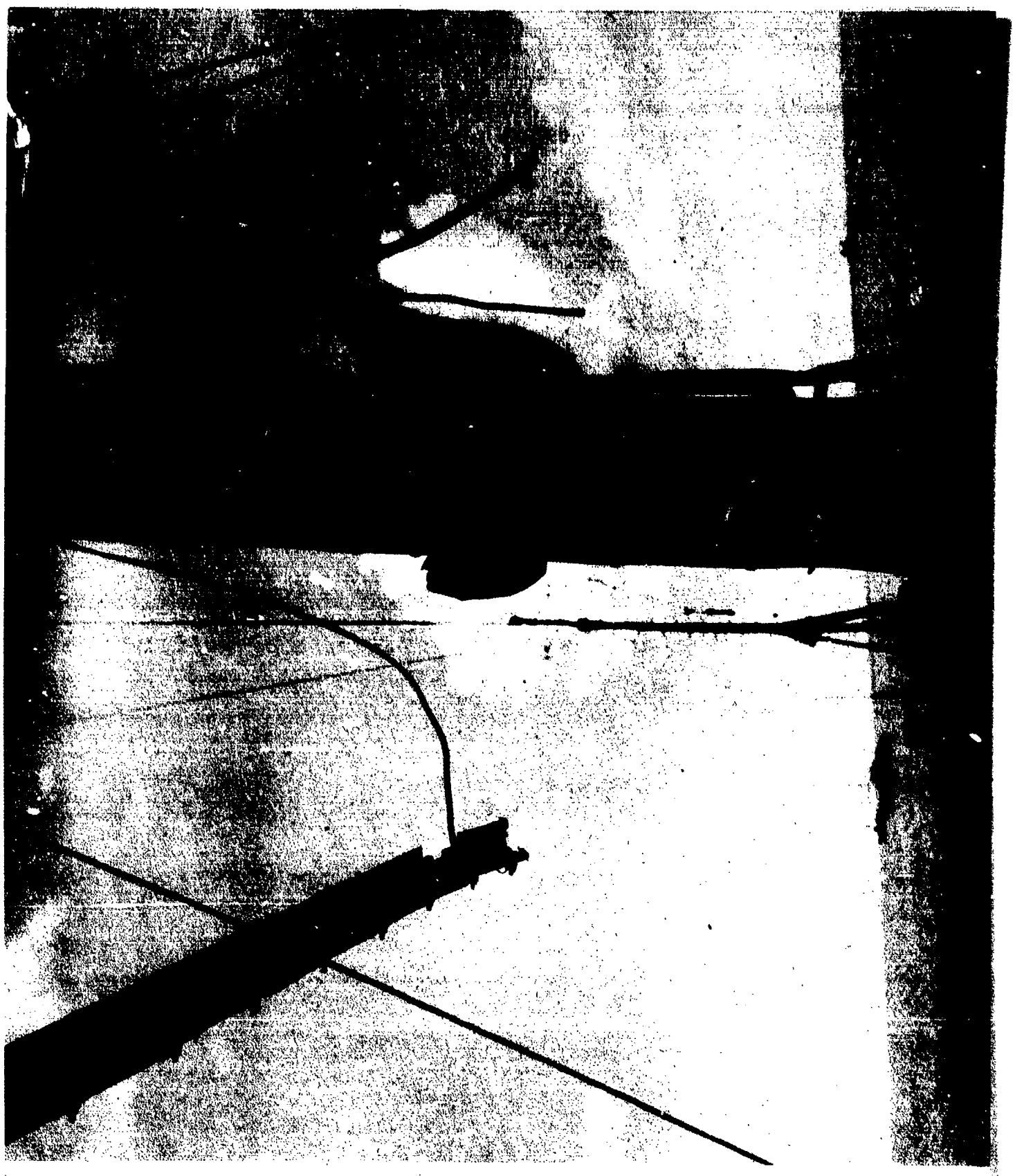


AA-CR-65-1817-3. View of bulwark showing distorted plating and stiffener and charred paint.

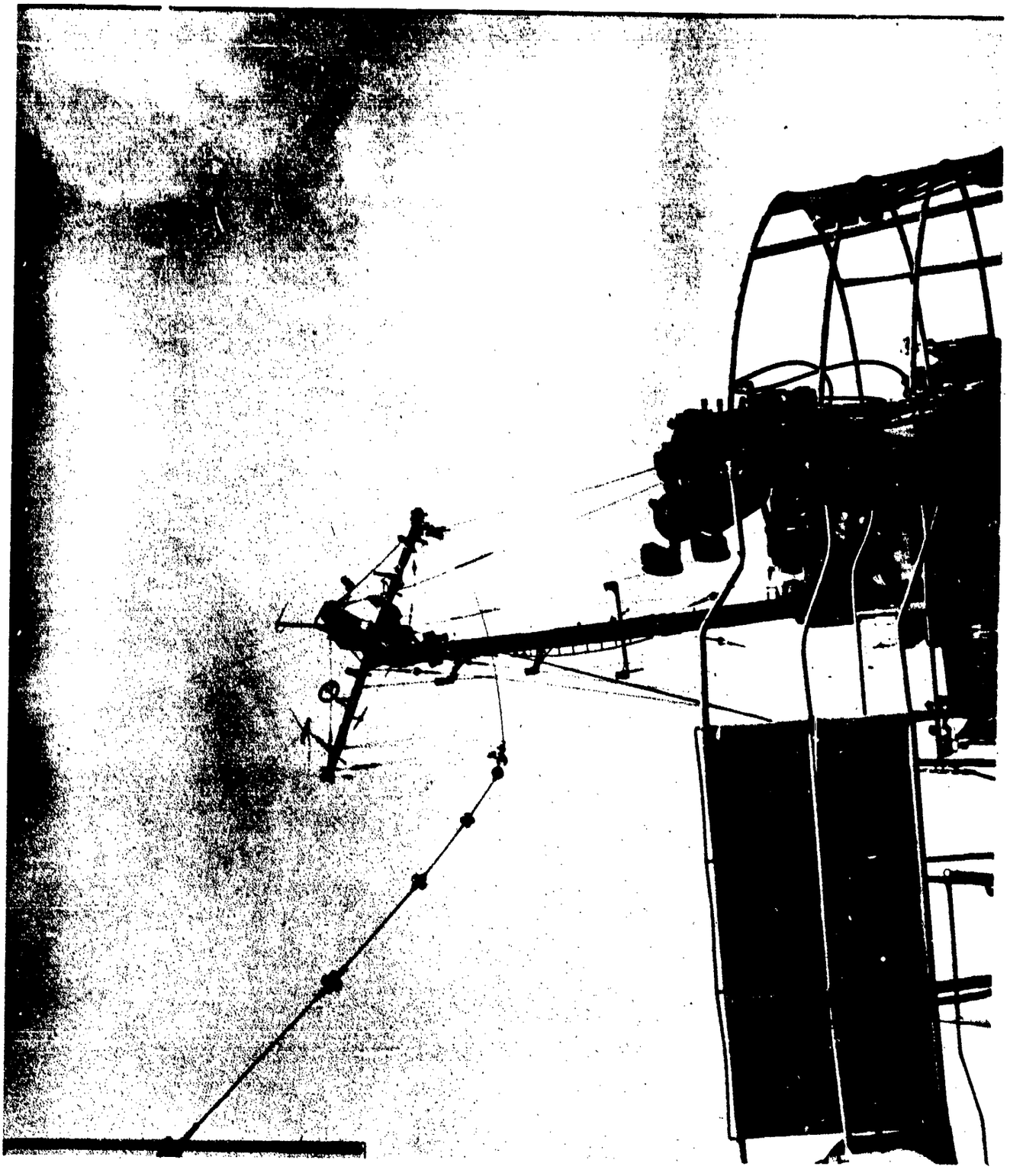
AA-CR-92-1771-12. View looking forward showing bottom of stack after it had been cut free from steam and drain lines.



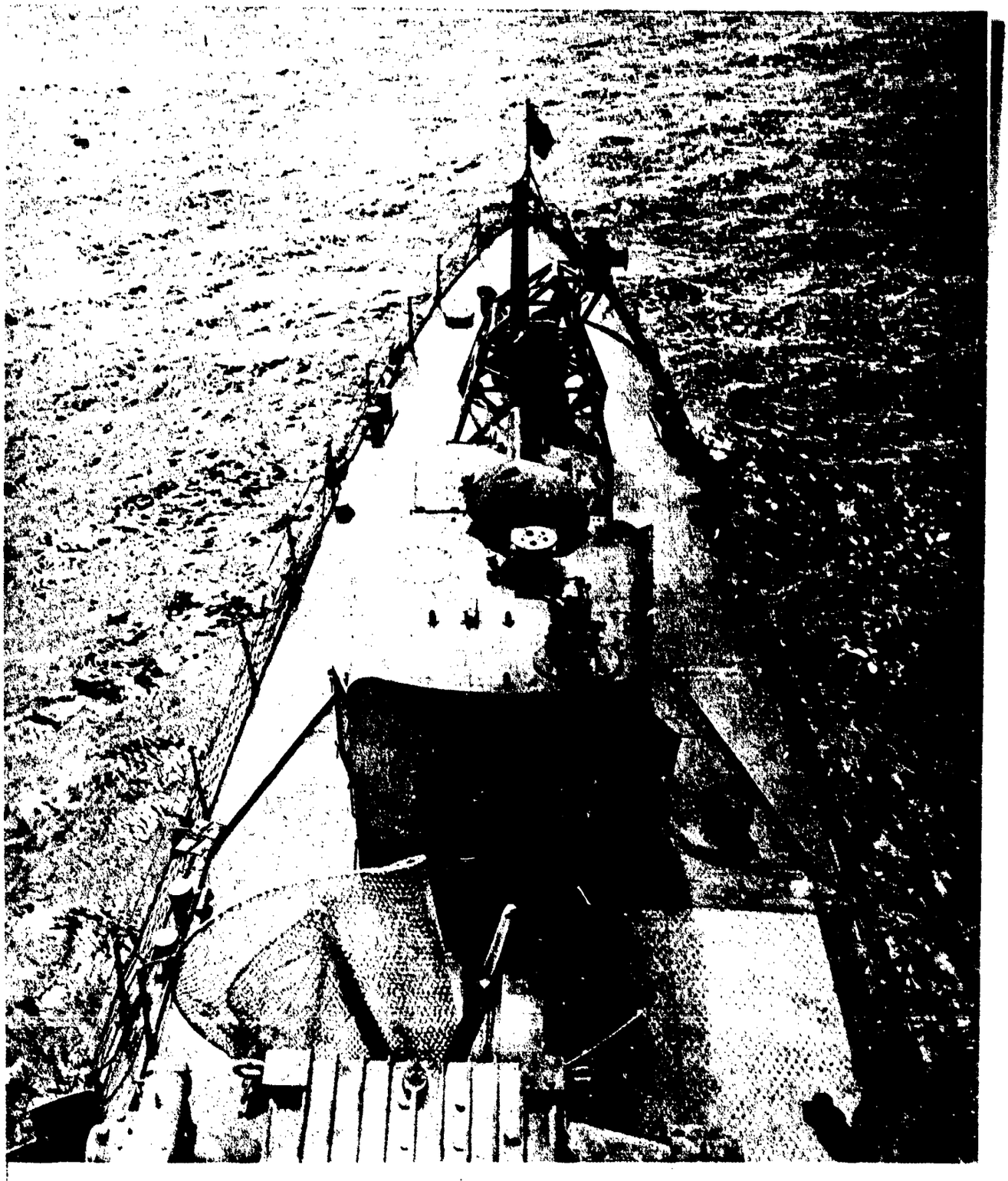
AA-CR-58-2003-4. View of foremast top from director platform.



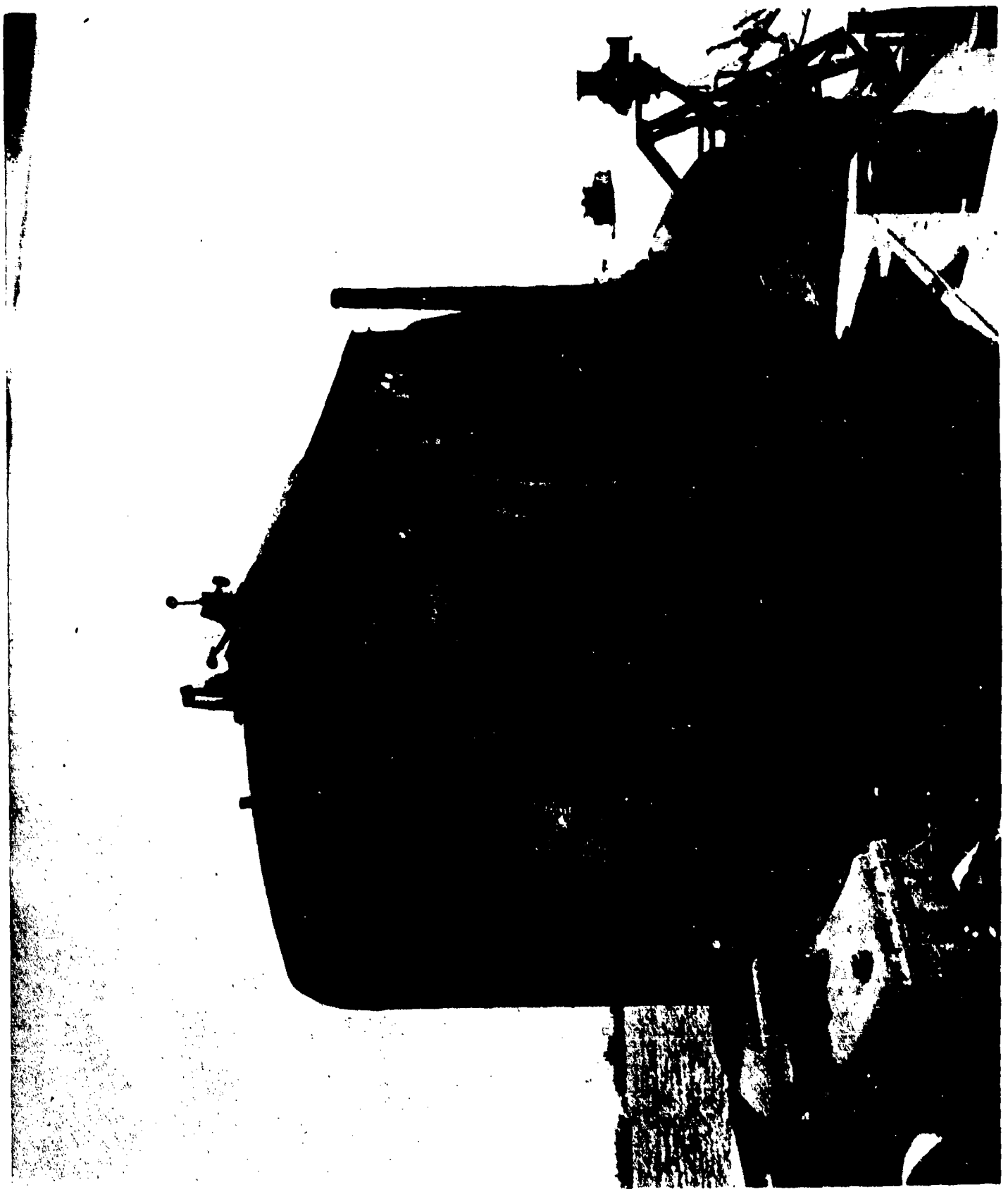
AA-CR-100-2200-2. Close-up view of mast and ladder damage looking aft from bridge structure.



AA-CR-100-2200-9. View of foremast damage looking forward.

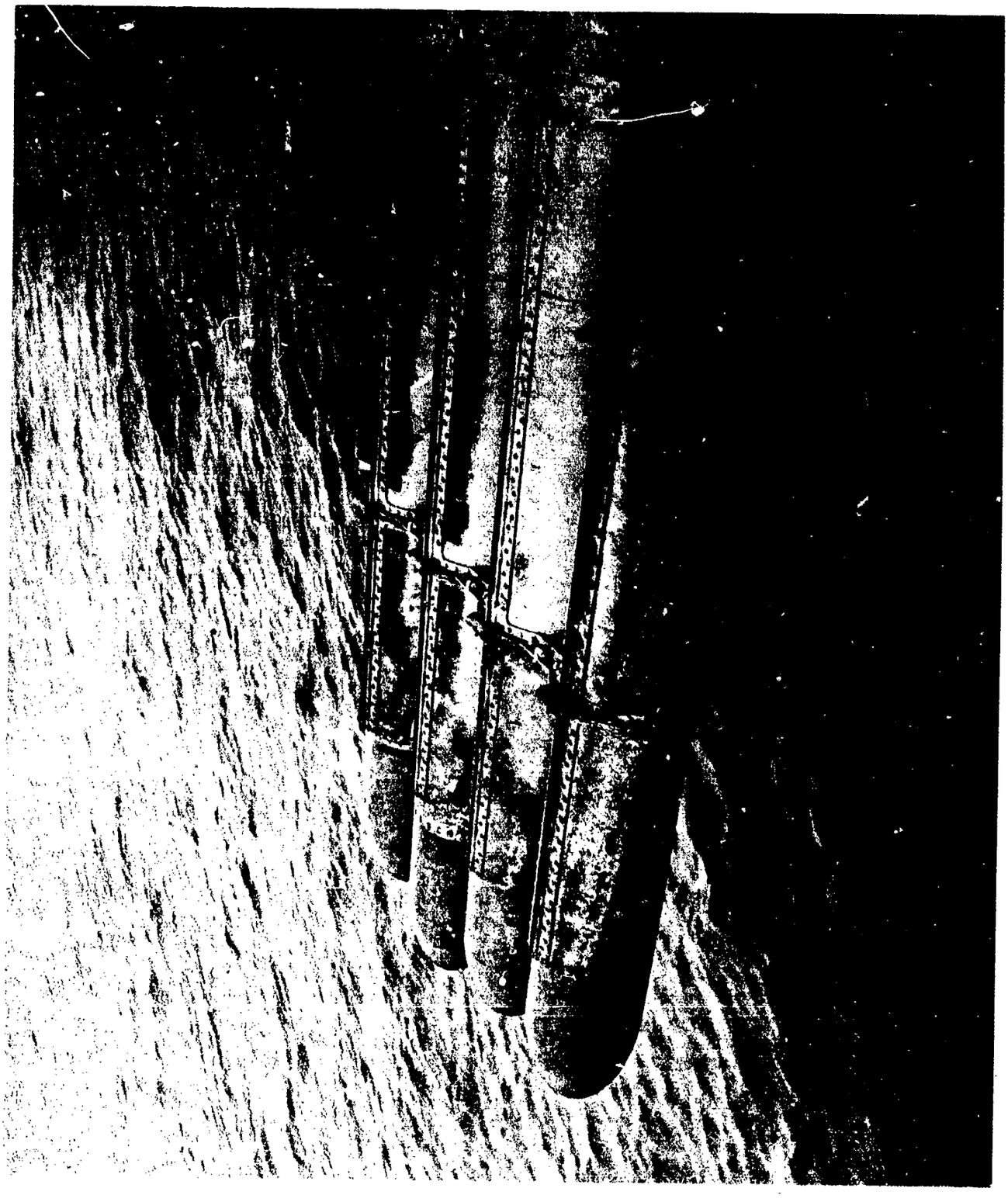


AA-CR-58-2003-3. View showing damage forward looking from sky lookout forward.

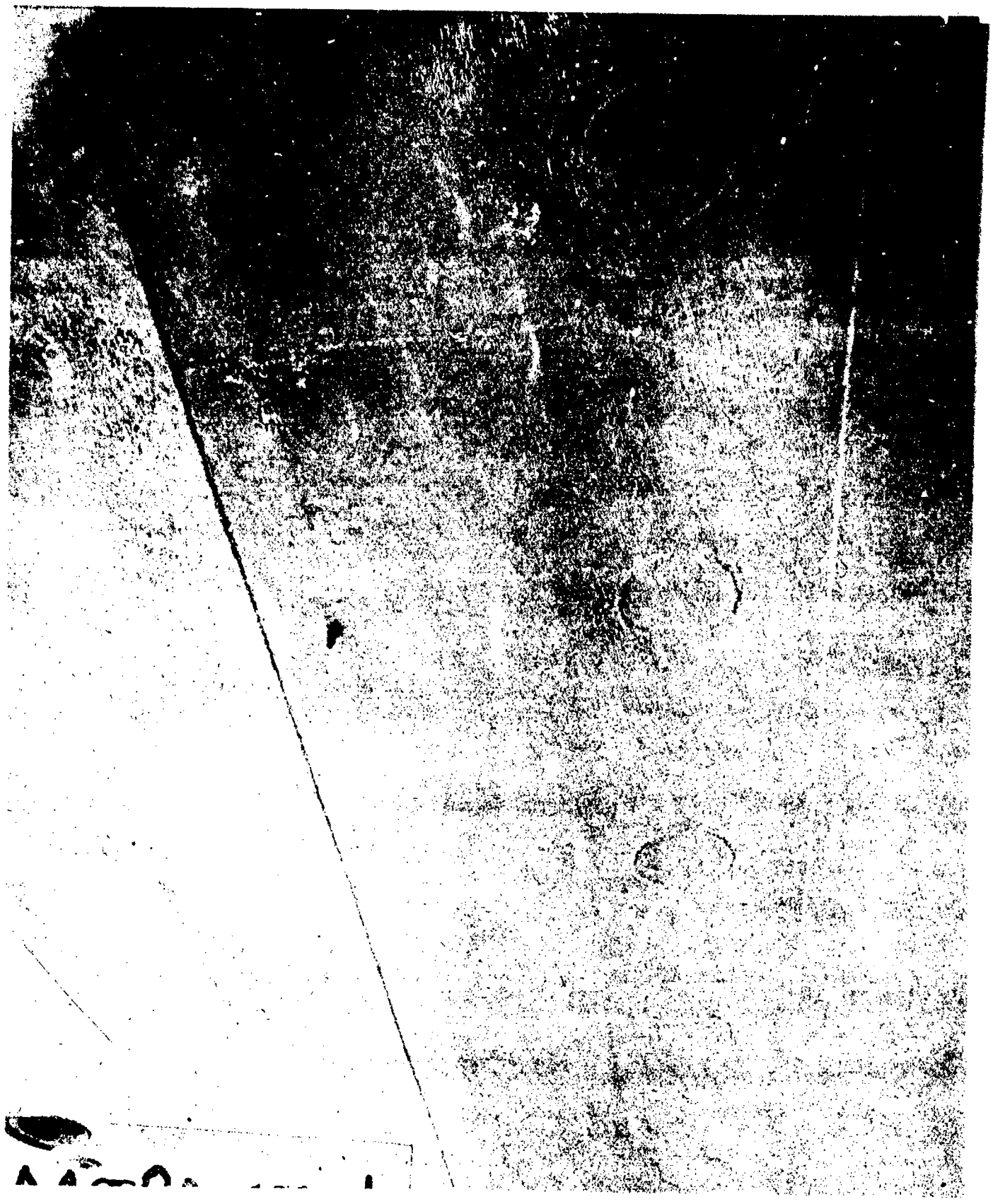


AA-CR-58-2010-12. View looking forward from bridge on 02 level showing damage to #2 gun shield and bent life line stanchions.

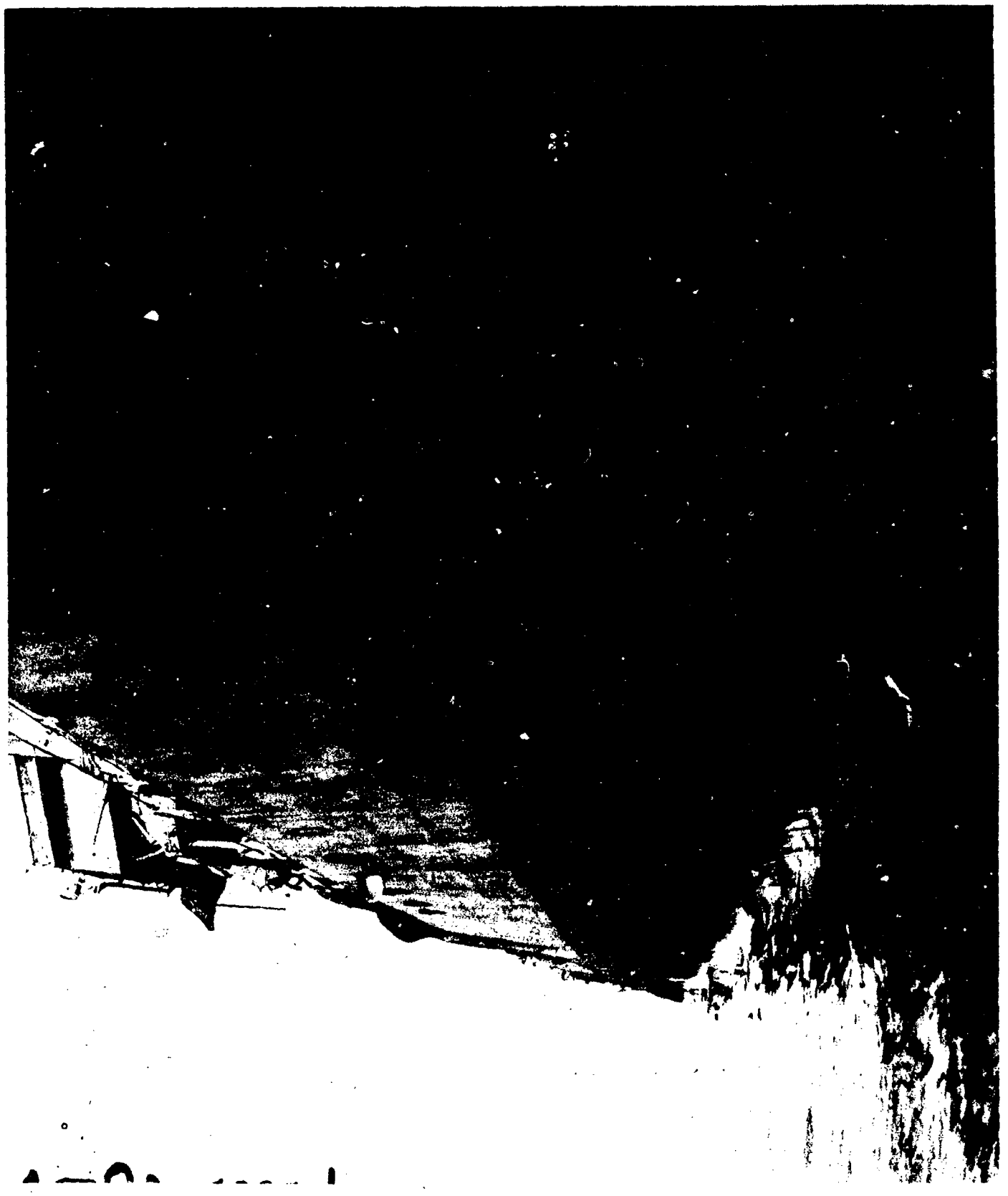
AA-CR-65-1817-6. View of #4 5'' gun mount showing burned bloomer and scorched paint.



AA-CR-92-1772-2. View looking aft along starboard side showing torpedoes extending from tubes as a result of Test A.



AA-CR-80-1895-1. View of starboard shell forward showing dishing of plating between webs and longitudinal.

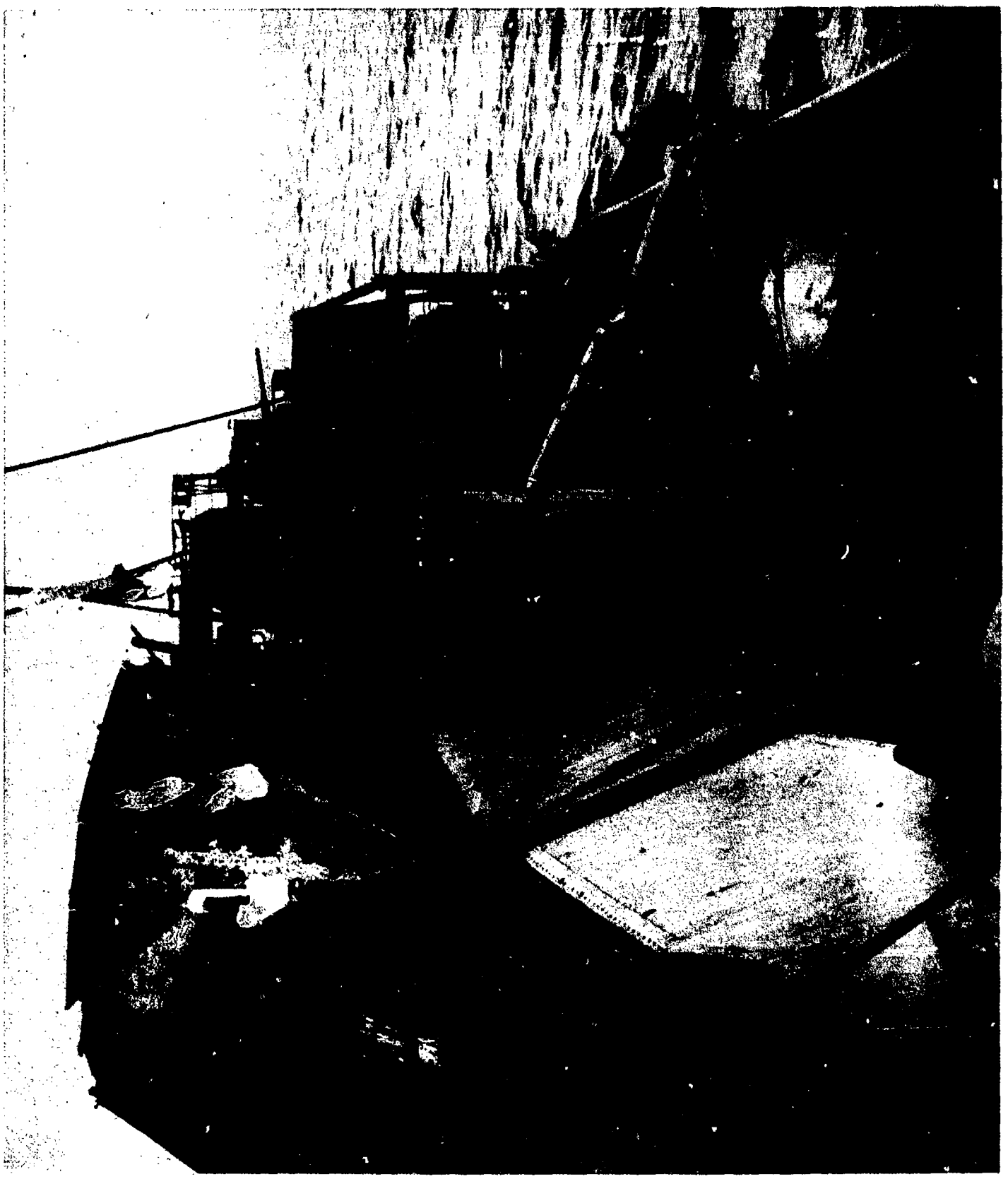


AA-CR-80-1895-2. View of starboard shell forward showing dished plating.

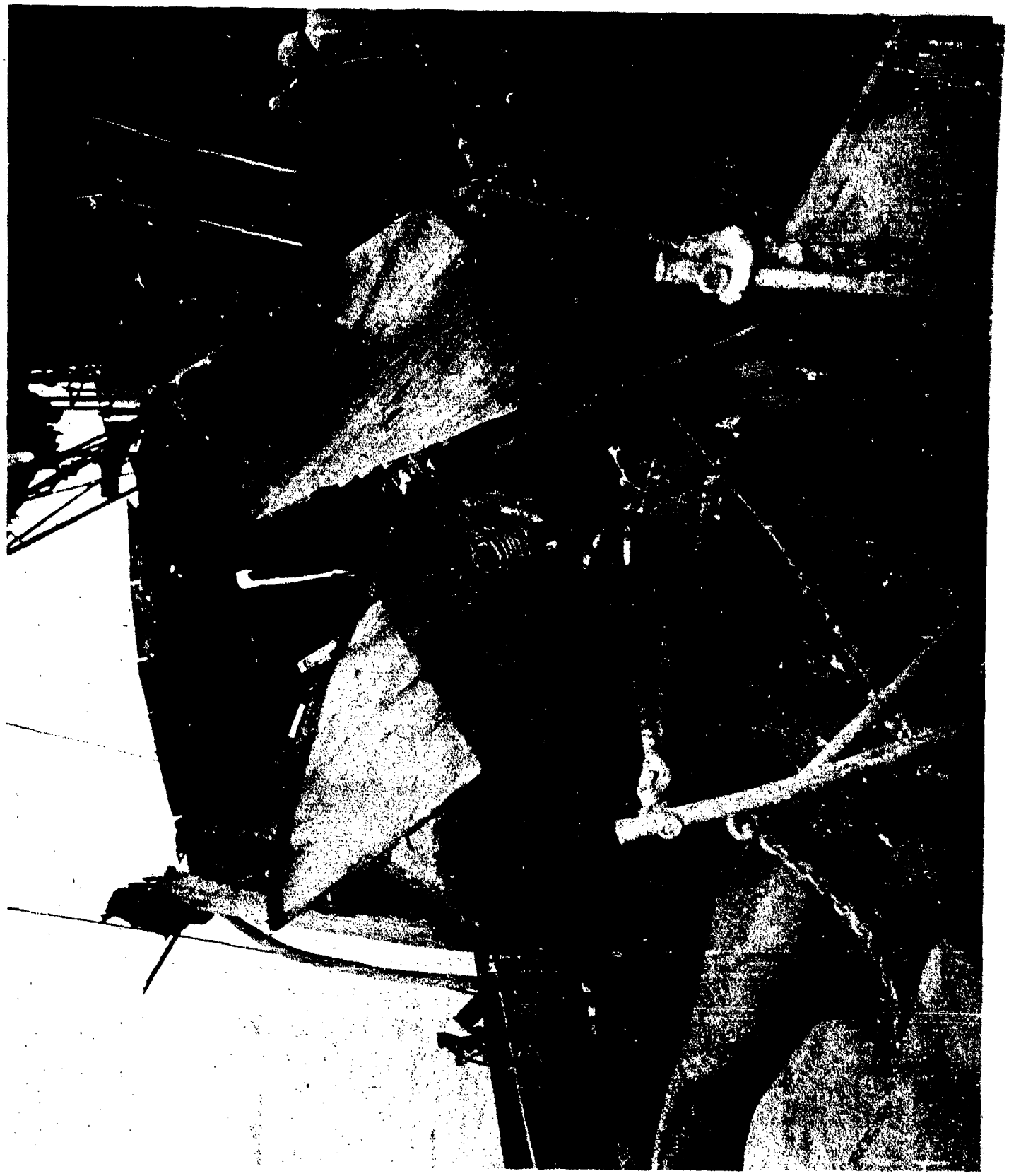
AA-CR-80-1895-3. View of starboard shell forward showing dished plating.

AA-CR-58-2003-8. No. 1 boiler cracked front wall.

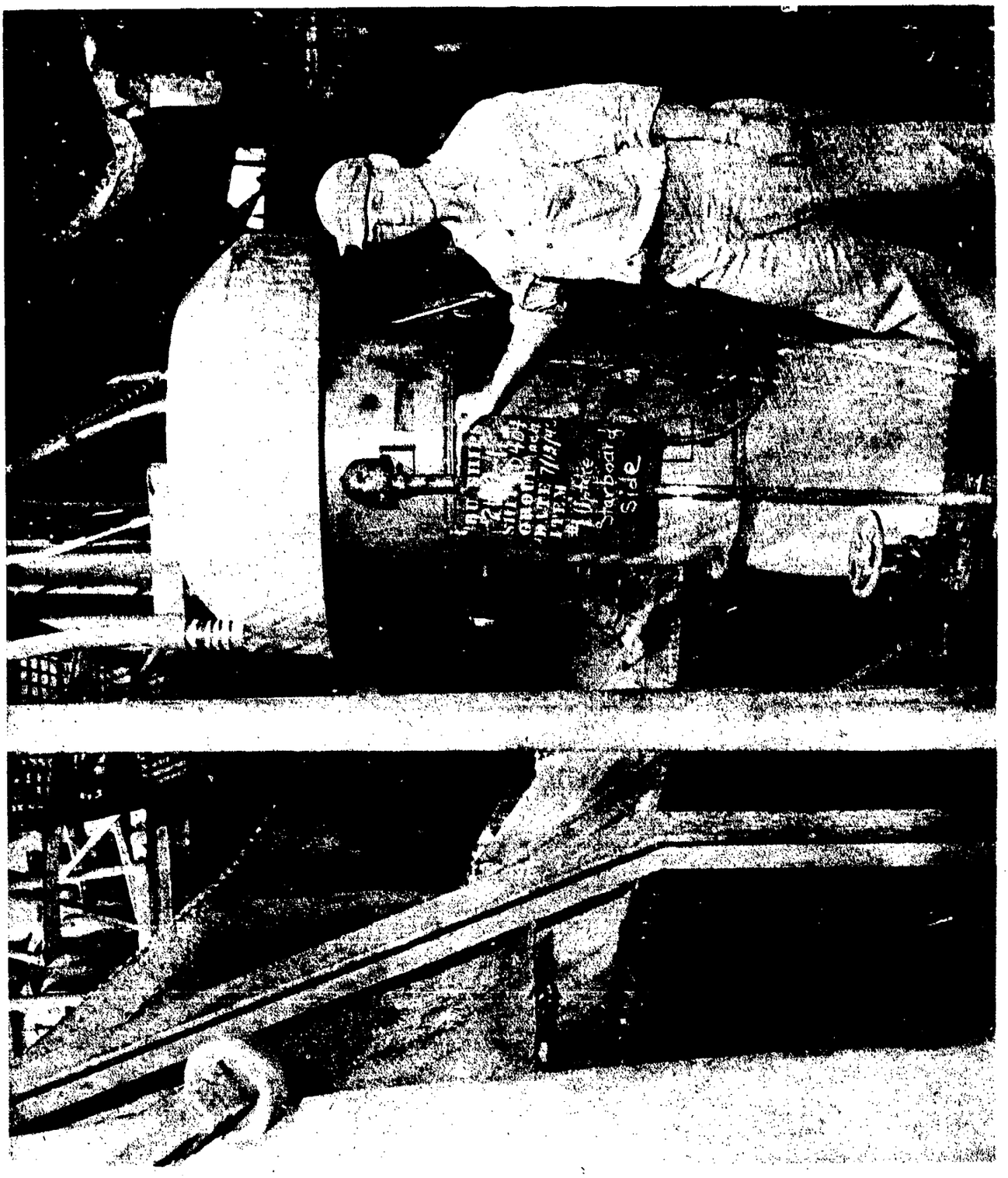
AA-CR-58-2003-6. No. 1 boiler, cracked rear wall.



AA-CR-58-2005-4. Square to round and breeching from main deck, port side.



AA-CR-58-2003-12. Looking at square to round, stack missing.



AA-CR-62-2170-1. No. 1 uptake, starboard side.

AA-CR-62-2170-2. No. 2 uptake, starboard side.

AA-CR-62-2170-4. No. 2 uptake, starboard side.

AA-CR-58-2005-1. Center and forward legs of breeching, starboard side.

AA-CR-58-2005-2. Looking aft at starboard side of breeching.

APPENDIX

SHIP MEASUREMENT DIAGRAM

TEST ABLE

APPENDIX

SHIP MEASUREMENT DATA

A. General Considerations.

A deck survey me hod was developed to determine the twist and longitudinal bending of each target vessel's hull girder resulting from an air or underwater burst of the atomic bomb. The procedure is as follows:

1. Select transverse sections. The maximum number of transverse sections used on any ship was six.

2. At each transverse section, select stations at which rod readings are to be taken. Center punch these stations in the deck. A minimum of five stations were used at each transverse section.

3. Establish throughout the length of the ship, by use of a surveyor's transit, a reference plane approximately parallel to the deck.

4. Take rod readings at every station on each transverse section.

5. Plot rod readings relative to a straight line representing the reference plane.

(a) Readings at each transverse section are plotted in order to obtain the configurations of individual sections and also to establish the relationship between sections.

(b) Readings at desired distances from the centerline are plotted in order to establish sheer lines. On most ships the actual readings are corrected for changes in sections resulting from local damage.

6. Repeat steps 3, 4, and 5 after the test using the stations established in steps 1 and 2.

7. Superimpose the after test plots on the before test plots in order to compare the conditions existing at the times of the two surveys.

The reference planes used in the before test and after test surveys are not necessarily parallel. Their relationship cannot be accurately determined because bench marks established before the test may be affected by local damage or by changes in hull alignment. Therefore, it is possible only to determine relative movement of any one section. The reference planes are disregarded after completion of the initial plots.

Twist of the hull girder is determined by superimposing one after test transverse section on the similar before test section and comparing the configurations of the remaining sections. Hog or sag is determined by superimposing before and after test plots of sheer.

The camber curves indicated in all plots are faired lines and do not show local deformation which may exist between the five station points.

B. Measurements.

1. Following the procedure outlined in paragraph "A", General Considerations, the Decl survey of the U.S.S. RHIND revealed negligible longitudinal bending. Therefore a profile of the sheer lines is not included in this report.

2. The before test survey was conducted at Pearl Harbor Navy Yard on March 21, 1946. Loaded conditions, temperature and sea conditions changed considerably between the before test survey and after test survey, the latter being conducted July 8th, 1946 at Bikini. These variations may have influenced somewhat the changes in the ship's hull.

3. Twisting of the ship's girder is shown in the plot of the transverse sections, page , selected at frames 66 1/2, 111, 130 1/2, and 162. When the before test and after test plots were

superimposed there was no change in the relative positions of sections at frames 162 and 130 1/2. At frame 111 at twist of 2'' to port relative to frame 130 1/2 and at frame 66 1/2 a twist of 3'' relative to frame 130 1/2 resulted from the test. This amounts to approximately 28 minutes torsional rotation (clockwise when viewed from aft) between frames 66 1/2 and 130 1/2, a distance of 112; and 16 minutes torsional rotation between frames 111 and 130 1/2, a distance of 34 feet.

4. Two deck deflection gages were installed between the forecastle deck and main deck and four gages between the main and second deck. Their positions and negligible readings are recorded on page [illegible].

A maximum compression of 1 inch was recorded at frame 172 1/2.

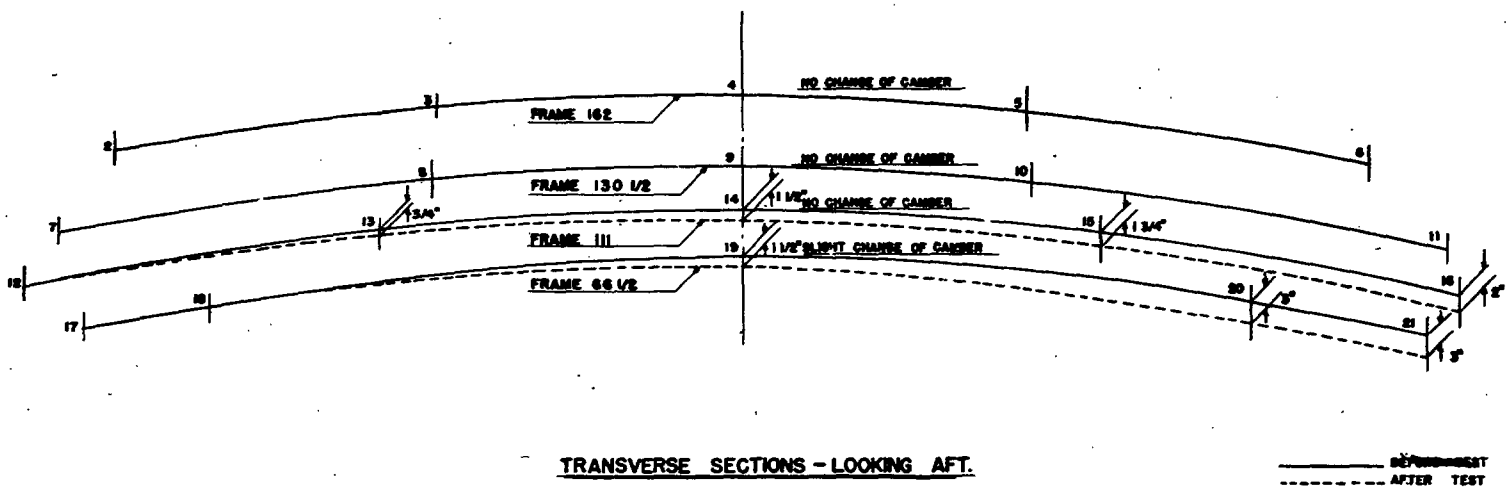
C. Summary of Changes in Shape of Hull.

1. Longitudinal sheer - negligible.

2. Shape of individual sections - negligible.

3. Torsional rotation - 28 minutes in 112 feet.

4. Deck deflection gages - readings negligible.



TRANSVERSE SECTIONS – LOOKING AFT.

——— BEFORE TEST
- - - - - - AFTER TEST

NAVY DEPT. BUREAU OF SHIPS
DECK SURVEY
TEST A
U.S.S RHIND DD 404

DECK DEFLECTION GAGES

SHIP U.S.S. RHIND-DD-404 **TEST A**

LOCATION			MAXIMUM COMP.	MAXIMUM EXP.	PERMANENT SET		REMARKS
FR. NO.	DECK	DIST. OFF ℄			DISTANCE	EXP. / COMP.	
18 1/2	MAIN	CENTERLINE	0-0- 1/4	NONE	NONE	NONE	NONE
37	MAIN	CENTERLINE	0-0- 1/4	NONE	NONE	NONE	NONE
37 1/2	2nd.	PORT	0-0- 5/16	NONE	NONE	NONE	NONE
151	2nd.	CENTERLINE	NONE	NONE	NONE	NONE	NONE
172 1/2	2nd.	STBD.	0-1-1	0-0- 5/16	0-0- 1/16	COMPT.	NONE
173	2nd.	PORT	0-0-20	0-0- 3/16	0-0- 1/16	COMPT.	NONE

APPENDIX

COMMANDING OFFICERS REPORT

TEST ABLE

REPORT #11

COMMANDING OFFICERS REPORT

PREFACE

This report is the Commanding Officer's independent observation, analysis, and opinion of the effect of the 1 July 1946 atomic bomb test on the USS RHIND (DD404). This ship is a 1500 ton destroyer of the BENHAM (DD397) class. Sister ships which were in the test were the USS MAYRANT (DD402), USS STACK (DD406), and USS WILSON (DD408). The RHIND was built in Philadelphia Navy Yard, and commissioned on 10 November 1939.

For eight months prior to the test the ship was operating with a very much reduced personnel allowance. This resulted in slightly sub-normal standards of material upkeep, but all equipment on board functioned, and all compartments below the main deck and forecastle deck were air-tested and found to be within acceptable limits. None of the boilers met the desired standards on hydrostatic tests, but all could be steamed. Some of the piping, notably the fire and flushing system and some auxiliary steam lines, were in very bad condition, although they were, and still are, in constant use. No other serious material deficiencies were noted during the pre-test inspections.

The remainder of this report follows the outline suggested in the Director of Ship Material's letter A11/Crossroads (FS/L11) of 4 April 1946. Where a subject listed in the outline is not applicable to this ship, or where it was unaffected by the test a statement to that effect is made in the index (Part B), but the subject is omitted from the body of the report (Part C).

SECTION I

PART A - GENERAL SUMMARY

1. Target Condition After Test.

Drafts after the test were identical with those taken before the test. There was no flooding and no change in loading except for the transfer of about 2000 gallons of fuel from A5 and A6 into A8. Subsequent shifting of fuel among these tanks indicates a leak into A8 from either A5 or A6, and a leak between the latter two, both caused by the explosion.

At the time this ship was evacuated it had 1/2° list to starboard, and when it was reboarded it had no list. This was undoubtedly caused by the stack, which had been blown over the side to port and was hanging by the steam and drain lines to the whistle and siren; and by the mast, which was inclined about 10° aft and to port. There were no other significant factors which affected stability.

Structural damage above the main deck was by far the most extensive and most serious result of the test. The stack was missing, the mast was bent and stripped of all antennaes and halyards, all weather doors toward the blast were blown in, the bulkhead to C. I. C. was demolished, and practically all unprotected superstructure vertical surfaces toward the blast (including 5'' gun shields) were dished. Paint on all surfaces directly exposed to the blast was charred or burned off. The hull below the main deck from frame 20 to 70 was dished, but no leaks resulted.

Surprisingly little damage was done to the interior of the ship. It was quite apparent that the destructive heat and pressure were of such short duration that areas shielded from the direct blast were practically unaffected, even where the protection was itself demolished. There was negligible amount of breakage inside of even such fragile equipment as light bulbs and radio tubes. Electrical wiring remained serviceable except where it was severed by flying debris. The diesel generator, which was operating during the test continued to run until the fuel was exhausted. Radio and radar antennaes and wave guides

were carried away, but the transmitters and receivers were undamaged except those mounted in the way of damaged structure. The main engines, two boilers, and all auxiliary machinery were undamaged. The third boiler could have been steamed for a short while in an emergency, but had some loose brick-work as a result of the blast. All guns could be operated in automatic, and the main battery director operated in optical control. The antennae of the fire control radar was demolished, however, and radar control was impossible. Steering control had to be shifted aft, but engine order telegraphs and interior communications still functioned, so ship control could remain on the bridge.

There was no evidence of secondary damage due to explosions or fires on the ship except possibly the canvas bloomers of 5'' guns No. 1 and No. 4. The bloomers on guns No. 2 and No. 3 were torn, but still clinging to the guns. On the other two, however, they were completely gone, only some ashes remaining to indicate that they may have burned.

It is considered probable that personnel casualties in exposed stations would be practically 100%. Even if proper clothing proved to be adequate protection from the heat, it is considered unlikely that personnel could withstand the suddenness and severity of the pressure. Casualties in enclosed spaces, on the other hand, are expected to be very low. This opinion does not take into account the possibility of casualties from radioactivity.

II. Forces Evidenced and Effects Noted.

Heat from the atomic bomb was obviously very intense. Every part of the ship that was directly exposed to the blast was scorched or charred in varying degrees. The direction from which the heat came was well defined in many places. Paint on deck was discolored except where it was shielded by guns, stanchions, etc. Paint on the vertical surfaces was badly burned except where shadows were cast by ladders, grab-rails, or other structure. A study of such evidence indicates that the blast occurred about 30 degrees forward of the starboard beam, and about 15 degrees above the horizontal.

There were a few exceptions to the rule that only those surfaces directly exposed to the blast were scorched. Part of the

inside of the starboard bridge wing bulkward was singed. Tubular structure of small dimension such as stanchions and pipes was burned on all sides, less severely away from the explosion, but still noticeable. It is possible that some of this "backside burning" could be caused by heat reflection from surrounging structure, but in most cases that explanation will not hold. It is considered more probable that a gust of superheated air which accompanied or immediately followed the initial heat caused this relatively minor scorching.

All of the effects of heat were apparently dissipated before the pressure wave reached the ship. Surfaces which were shielded from the blast at the instant of the explosion, but later exposed to it when the pressure wave destroyed the protection, were unburned. This fact was clearly demonstrated by a ladder which was displaced by the pressure wave, but which left an unburned pattern on the adjacent bulkhead corresponding exactly to the ladders' original position.

By far the most extensive damage to the ship was caused by the pressure wave. The position of materials displaced by the pressure bears out the conclusions on direction and altitude of the blast discussed in the paragraphs on heat effects. Unlike the heat, the pressure was exerted also on the side away from the blast, although not of the same intensity as on the side toward the blast. Every weather door on the starboard side was blown in - about half of them on the port side were damaged. All superstructure bulkheads and bulwarks on the starboard side were damaged, ranging from slight dishing to complete destruction, those on the port side show only very slight effects. The hull above the waterline from the break of the deck forward was dished on the starboard side - port side shows no evidence of such strains.

The result of the blast on the weather doors is of particular interest. It was around these doors, where vertical framing is interrupted, that the most serious superstructure damage occurred. In all cases the frames on either side of the doors held, or bent slightly, but the door coaming and the bulkhead area immediately adjacent to it failed. The doors themselves were not strong enough to withstand the full force of the blast, but they evidently could stand more than the unsupported bulkheads in which they were hung.

Half of the doors on the port side, away from the blast, were damaged, the other half unaffected. The reason for this is not the presence of surrounding, and possibly protective, structure, but the introduction of compensating pressure inside the compartment from door failures on the starboard side. The port side doors which were damaged gave access to compartments which were otherwise virtually air tight even after the blast. Those doors which withstood the pressure gave access to spaces which were opened on the starboard side by the first effect of the blast wave, thus permitting a pressure rise inside the compartment, and compensating for the increase outside enough to prevent damage.

Except as noted around the doors only one bulkhead failed completely. That was the starboard side of CIC, directly beneath the bridge. This is a riveted aluminum bulkhead with aluminum frames. Three frames broke, and one riveted seam popped all rivets. Aluminum rivets were also popped on the forward side of the bridge. In addition to the damage discussed above, the pressure is considered to be primarily responsible for the loss of the stack and antennaes, bending of the mast and life line stanchions, and seriously damaging the motor whaleboat.

There is evidence of considerable shock at the time of the test, but very little damage resulted from it. Loss of light bulbs was no more severe than might be expected from firing 5" guns. Shock-mounted electronic equipment came through unharmed. There were scratches on the diesel generator which showed that it had lifted about half an inch off its foundations, but it was undamaged. Most ladders throughout the ship were jolted out of their supports at the bottom, but all could be easily reset except three which were otherwise damaged by direct exposure to the pressure wave.

III. Results of Test on Target.

The comments here on operation capabilities after the test do not take into account the possible high percentage of personnel casualties.

The hull remained intact, although probably somewhat weakened, and the main engines and essential auxiliaries were undamaged. It is believed that the ship could have steamed indefinitely at any speed up to 26 knots in favorable weather, and for a short while

in an emergency could have made close to full power. Loose bricks in No. 1 boiler would have prevented continued high speed 3-boiler operation.

Stability was not affected and watertight integrity below the main deck was not seriously impaired. Weather however, would very seriously affect operations because the blast had opened the superstructure so extensively. Rain or heavy spray would inevetable work inside and cause flooding and electrical failures. In addition to that a relative wind from ahead of more than 20 knots would drive smoke into the engine rooms because of the missing stack, and would probably make them untenable.

Ship control could have been maintained on the bridge by use of auxiliary steering methods. Exterior communications would have been seriously impaired until emergency antennaes were strung. It is estimated that essential facilities could have been restored within 2 hours with the materials and personnel normally carried. Radars were useless because wave guides were destroyed. All guns were still operable and fire control systems intact except for the fire control radar. Roller path data has not been taken since the test, but a horizontal check indicates no discernable misalignment.

It is thus concluded that the ship could be expected to return to port under its own power, but that its ability to continue an offensive action would be considerably reduced. Prolonged operation with carrier groups would be impossible. It would be difficult, if not impossible, to maintain a screening station in any large formation. Shore bombardment, other than close in direct fire, would be impossible. Torpedoes could be launched, and a daylight air attack could be combatted, but with questionnable accuracy. The tactical uses of a ship damaged as this one was are very limited.

IV. General Summary.

It appears that the RHIND was very close to the limiting lethal range for this type of vessel from an air burst. Had the ship been a few yards closer to the blast, it is considered that serious and perhaps fatal hull damage would have occurred; a few yards further away and much of the superficial damage, which together considerably lowered overall efficiency, would have been negligible or easily repaired.

V. No comment.

SECTION I

PART C - INSPECTION REPORT

SECTION A - HULL

A. General Description of Hull Damage.

Hull damage, primarily a result of pressure, not heat nor shock, was the most significant and disabling damage suffered. The hull itself was dished, but not opened, through almost the entire length of the ship on the starboard side, which was toward the blast. Superstructure bulkheads, bulkwarks,and other structure were damaged or demolished on the starboard side. The stack was carried away entirely. The mast and most exposed stanchions were bent away from the blast.

All of this damage was a direct result of the pressure wave. The heat was intense, as evidenced by burned paint on all surfaces directly exposed to the blast, and there were some signs of shock. Hull damage from these factors was negligible, however. No fires were started and the scorching in no way affected operation of the ship. Buoyancy and stability remained unchanged and watertight integrity still met acceptable standards. The ship's ability to withstand further such blasts or heavy weather was undoubtedly reduced, but in the ten days since the test no signs of progressive weakening have been noted.

B. Superstructure (exclusive of gun-mounts).

Much of the superstructure damage has been described in preceding paragraphs of this report, but it is repeated here in order to provide a comprehensive summary of all such damage. The arrangement of the following outline is from forward, aft, but not necessarily in order of severity of damage.

1. One panel of forward bulkhead of pilot house opened where rivets popped.

2. Two ports in pilot house blown in, one shattered, the other intact.

3. Flag bags demolished.

4. Starboard bulkhead to A-0201C (CIC) opened by failure of riveted seam and three frames.

5. Mast bent 10° aft and to port, parting 2 guys.

6. Stack blown over the side, atmosphere exhaust and whistle and siren piping bent to waterline to port.

7. Uptakes torn and pierced.

8. Catwalk from forecastle deck to after deckhouse warped.

9. Main deck bulkwarks, port and starboard, distorted.

10. All longitudinal bulkheads exposed to the blast were dished, framing in some cases bending.

11. All weather doors on the starboard side, and about half of those on the port side were badly sprung.

12. All unprotected stanchions were bent aft and to port.

13. Brackets at the foot of the starboard inclined ladders were destroyed.

Plating throughout the superstructure is light, at no place more than 7 1/2#. It is all either mild steel or aluminum, and the framing is all one of those two metals.

The CIC bulkhead, which was most seriously damaged of any on the ship, is 3/16'' aluminum with aluminum frames. Three of the frames broke, all in places where bolt holes had been drilled through them. The bulkhead itself was torn and a riveted seam opened.

In radio central, A-0104C, which has part steel and part aluminum framing behind and aluminum bulkhead, the steel frames held, but aluminum ones cracked. The bulkhead itself remained intact. In the crews washroom, C-103L, steel frames carried away, but the bulkhead held. The frames here were badly rusted and weakened before the test.

From these facts it is concluded that aluminum frames cannot be expected to withstand the pressures that the ship was exposed to. Steel frames may be expected to bend, but they will not break if rust preventative measures are adequate. Both steel and aluminum bulkheads bent slightly under the pressure, but did not part if the framing behind them withstood the blast. Aluminum rivets popped where the surrounding structure was seriously misshapen, but held where they were used immediately adjacent to fire structure.

C. Turrets, Guns, and Directors.

All 5''/38 guns and mounts survived the test virtually undamaged. Gun shields were dished, however, on the side toward the blast. The framing was bent, but all bolts, rivets, and welded seams held. The distortion of the shields did not affect operability of the guns.

One recoil spring on a starboard 40MM mount was broken, but otherwise all 40MM and 20MM guns functioned normally. None of the guns have been test fired since the explosion, but visual inspections give no reason to expect any failures.

The MK 33 director could still be used for optical control, the range finder and rangekeeper being undamaged. The radar antennae and its rotating diapole were broken and the stable element was inoperable, however. In the latter, one of the level gimble bearings had backed out, and six of the eight amplifier and rectifier tubes were broken. Welded seams on the director shield cracked but no serious damage resulted.

One of the MK 51 directors was still operable, the other not. The handle of the forward director, which was trained 300° relative to the blast was bent down and around the director

stand making it impossible to train or elevate. The power lead to the sight on this director was broken also, apparently severed by a part of the demolished shield around the director. The other MK 51 director, which was trained 030° relative to the blast was undamaged, although exposed to the full force of the blast. Ray filters on the MK 14 sights of the starboard 20MM guns were jammed, but otherwise the sights were operable.

D. Torpedo Mounts and Depth Charge Gear.

The tropedoes in the port mount were unaffected by the blast. Those in the starboard tubes, which were trained to 090° relative, were jolted about three feet out from their normal positions. It is believed that this movement was caused by the shock, or the pressure wave, or a combination of both. This movement was sufficient to break the tension link which normally holds the torpedoes in proper position, but was not enough to operate the inertia starter and starting lever. The torpedoes had not run, and were still holding full aircharges when inspected after the test.

E. Weather Deck - Fittings.

The weather deck remained intact and watertight except for some relatively minor leaks around rivets in the exposed part of the 02 deck immediately abaft gun #2. Other decks throughout the ship were buckled slightly but no cracks or otherwise weakened areas were found. This minor damage was caused by strains imposed by the action of the pressure wave on vertical surfaces integrated with the decks in question. The usability of the decks was unimpaired.

The motor whaleboat was not serviceable after the test. No rib failures were noted, but the sheer strake and beading were cracked, the exhaust line was parted, and three of the four batteries were cracked. The davits were undamaged except for a cracked block at the forward davit head.

Two of the liferafts were missing and two others were moved from their cradles. In all four cases the wire straps which secure them parted. The rafts which remained on board were, themselves, undamaged, but all equipment lashed to one of them was carried away.

F. Exterior Hull Above Waterline.

At no place was the hull cracked or opened by the blast, but the entire starboard side is dished. The indications are much more distinct forward where the ship has 17 feet of freeboard than aft where it has only about 8 feet. Decks and major transverse bulkheads were not appreciably distorted, and the pattern formed by these principle strength members can be clearly seen from outside. The lighter transverse and longitudinal frames between them, however, sagged under the weight of the pressure, and the resulting dished areas are as much as two or three inches deep. A survey of the main deck showed no marked changes in dimensions or shape of the ship's grider, and it is considered that there was negligible impairment of hull strength.

G. Interior Compartments Above Waterline.

Joiner bulkheads were slightly distorted by the compression of the ship's girder resulting from the pressure wave. No other affects were noted in interior compartments - access closures were undamaged, piping and wiring remained unharmed, no fires occurred, and watertight intergrity was unaffected. Habitability and utility of the compartments were unchanged.

H. Armor Decks, and Miscellaneous Armor.

Not applicable.

I. Interior Compartments Below Waterline.

No damage.

J. Underwater Hull.

No damage.

K. Tanks.

Fuel oil leaks developed between A-5F and A-6F, and between one of those tanks and A-8V. It has not been possible to make inspections to determine the nature and extent of these leaks.

Transfer of oil among these tanks clearly indicates their existence, however. These leaks do not affect ship operability except that ballasting procedure must be modified, and slightly below optimun stability characteristics accepted.

L. Flooding.

No damage.

M. Ventilation (Exclusive of Blowers).

Ventilation systems throughout the ship stood up well. Damage to ducts was noted in only one place, supply to the forward engine room. The section of duct that is damaged is outside and was directly exposed to the blast. It was badly bent, but still usable. Most of the ventilation systems have watertight closures on the weather openings, so no heat or blast effects were introduced into the ship through them. Ventilation to the diesel generator room was open, however, but even here there was no evidence that heat or pressure was conducted below decks.

N. Ship Control.

Ship control suffered most seriously in loss of external communications and radar information. 12" signal searchlights remained usable but radio and flag hoist communications were rendered temporarily inoperative. It proved to be a relatively simple matter to renew antennaes and halyards to handle essential traffic. CIC could have been put in shape so that voice radio circuits could be guarded there, but otherwise it was useless, and repairs were beyond the capacity of the ship's force. CIC proved to be the most vulnerable of the ship control stations, but it is considered that there is little to be gained in protecting it unless antennae arrays and wave guides are made much more durable.

O. Fire Control.

Damage to fire control station is discussed under Section A, Item C - Turrets, Guns and Directors.

P. Ammunition Behavior.

No damage.

Q. Ammunition Handling.

No damage.

R. Strength.

All evidences of hull strength impai ment are discussed in Section A, Item F - Exterior Hull Above Waterline.

S. Miscellaneous (State Subject).

No remarks.

SECTION I

PART C - INSPECTION REPORT

SECTION B - MACHINERY

A. General Description of Machinery Damage.

Loosening of the brickwork in No. 1 boiler was the only damage that seriously limited operation of propelling or auxiliary machinery. This, and all other machinery damage, appears to be a result of shock rather than pressure or heat. This ship has been underway under its own power since the test and no difficulties were encountered.

B. Boilers.

Of the three boilers on the ship, only No. 1 showed evidence of major damage resulting from the test. The decks and wall of both furnaces of this boiler were cracked in several places. The front brickwork on the saturated side of the boiler was jarred loose. Five handhole plates on the superheater header of No. 2 boiler were loosened and leaks around the gaskets resulted. This was the only boiler damage sustained and was far from disabling. Even No. 1 boiler could have been steamed for a short while in an emergency. Hydrostatic tests made after the explosion showed no appreciable loss of tightness or strength.

C. Blowers.

No damage.

D. Fuel Oil Equipment.

No damage.

E. Boiler Feedwater Equipment.

No damage.

F. Main Turbines.

No damage.

G. Reduction Gears.

No damage.

H. Shafting and Bearings.

No damage.

I. Lubrication System.

No damage.

J. Condensers and Air Ejectors.

No damage.

K. Pumps.

No damage.

L. Auxiliary Generators (Turbines and Gears).

No damage.

M. Propellers.

No damage.

N. Distilling Plant.

No damage.

O. Refrigeration Plant.

No damage.

P. Winches, Windlasses, and Capstans.

No damage.

F. Main Turbines.

No damage.

G. Reduction Gears.

No damage.

H. Shafting and Bearings.

No damage.

I. Lubrication System.

No damage.

J. Condensers and Air Ejectors.

No damage.

K. Pumps.

No damage.

L. Auxiliary Generators (Turbines and Gears).

No damage.

M. Propellers.

No damage.

N. Distilling Plant.

No damage.

O. Refrigeration Plant.

No damage.

P. Winches, Windlasses, and Capstans.

No damage.

Q. Steering Engine.

No damage.

R. Elevators, Ammunition Hoists, Etc.

No damage.

S. Ventilation (Machinery).

No damage.

T. Air Compressors.

No damage.

U. Diesels (Generators and Boats).

The diesel engine in the motor whaleboat has not been run since the test. Wiring and batteries in the boat were destroyed and the exhaust line parted. Visual inspection shows no other evidence of damage. Broken wiring was replaced with a jury rig and the engine turned over a few revolutions. Adequate wiring to carry the load more than a few seconds was not available, however, and the engine was not started.

V. Piping.

The following is a list of the piping that failed during the test, probably due to shock:

1. Steam drain from laundry pressing machine.
2. Cooling water line to lube oil cooler on No. 1 fuel oil service pump.
3. Cooling waterline to lube oil cooler on No. 4 forced draft blower.
4. Fresh waterline to heater in the crew's shower.

All of these lines were badly rusted prior to the test, and, but for that fact, it is believed that these casualties would not have occurred.

W. Miscelianeous (State Subject).

No remarks.

SECTION I

PART C - INSPECTION REPORT

SECTION C - ELECTRICAL

A. General Description of Electrical Damage.

Electrical damage was confined to minor or easily repaired damage. Fuses to the battery charging switchboard were knocked out, three of the four batteries in the motor whaleboat were cracked, the control panel on the low pressure air compressor was broken, fuses to the fresh water pumps were knocked from their clips, and eleven rough service lamps were broken by the shock. The 36'' searchlight carriage was distorted and rendered inoperable by the pressure wave. A small amount of wiring on the mast and other exposed locations was severed by flying debris or pulled from receptacles. This small amount of electrical damage did not materially affect the operability of the ship, and only the 36'' searchlight was beyond the capacity of ship's force to repair, at least temporarily, within a short time.

B. Electric Propulsion Rotating Equipment.

Not applicable.

C. Electric Propulsion Control Equipment.

Not applicable.

D. Ship's Service Generators.

No damage.

E. Emergency Generators.

No damage.

F. Switchboards and Distribution Panels.

See Item A.

G. Wiring, Wiring Equipment and Wireways.

See Item A.

H. Transformers.

No damage.

I. Submarine Propelling Batteries.

Not applicable.

J. Portable Batteries.

See Item A.

K. Motors, Motor Generator Sets and Motor Controllers.

See Item A.

L. Lighting Equipment

See Item A.

See Item A.

M. Searchlights.

See Item A.

N. Degaussing Equipment.

No damage.

O. Gyro Compass Equipment

No damage.

P. Sound Powered Telephones.

No damage.

Q. Ship's Service Telephones.

No damage.

R. Announcing Systems.

No damage.

S. Telegraphs.

No damage.

T. Indicating Systems.

No damage.

U. I. C. and A. C. O. Switchboards.

No damage.

V. F. C. Switchboards.

No damage.

SECTION I

PART C - INSPECTION REPORT

SECTION D - ELECTRONICS

A. General Description of Electronic Damage.

Practically all of the electronic equipment on board this vessel was put out of commission temporarily because of damage to the exposed portions of the gear. All radio antennas were carried away. The SG radar wave guide was torn from the mast. The Mark 28 Fire control radar antenna was bent out of shape and its rotating diapole was broken. Apparently all damage was caused by shock and the pressure wave following the blast.

In CIC, the SCR 608 was torn from its bulkhead mounting and thrown 7 feet to the deck. The other radio sustained only minor breakage such as normally experienced from gun fire. Except for the SCR 608 and the rigging of aerials, all radios could be put back into commission with about 15 minutes work on each.

The remainder of this section on electronics is a detailed outline of the damage discovered,and omits those items listed in the index which continued to function normally.

B. Fire Control Radar.

The Mark 28 radar would not operate after the test because the reflector screen was bent and broken and the rotating diapole was broken off. The remainder of the gear escaped damage.

C. Surface Search Radar.

The SG radar would not operate after the test because of the demolished wave guide. The antenna still rotated although tilted about 30° from horizontal because of mast damage, and the remainder of the gear escaped damage.

D. Air Search Radar.

Not applicable.

E. Radar Repeaters.

No damage.

F. Radar Counter Measures Equipment.

Not applicable.

G. Radar and Radio Beacons.

Not applicable.

H. IFF Equipment.

No damage.

I. Communication Transmitters (Radio).

TBK-19	Radio transmitting equipment.	Filament of PA tube (861) Broken. Overload relay kicked out.
TBL-7	Radio transmitting equipment.	Overload relay kicked out. Fuse F-451 blown in plate voltage circuit.

J. Communication Receivers (Radio).

RBS-1	Radio receiving equipment.	Torn loose from mountings. All cables and connections severed. No tubes broken. Operation normal when connected.

K. Communication Antennae (Radio).

The antennae for the following radios were damaged:

RBK 14	TDQ	RBB 1
RBO	TBS	RBC 2
RCK	RAL 7	SCR 608
TBK 19	RAK 7	MN
TBL 7	RAK 1/RAL 1	RBS 1
TCS 12	RBA 3	

L. Radio Transceivers (Combined Transmitters and Receivers).

TCS 12 (Ser. 15183)	All transmitter tubes replaced before normal operation. Transmitter operated with emergency antenna. Receiver operated with a new set of tubes.
TBS	
TCS 12 (Ser.12583)	Relay for transmitter dynamotor not closing properly. This is probably being caused by weak batteries. Normal operation in other respects.
MBF	Receiver operates but transmitter will not put out. Transmitter seems to load properly. Cause for poor operation has not been determined.
SCR 608	This was torn loose from its mounting in CIC and thrown 7 feet to the deck. All connections were broken. The dynamotor was broken by the fall.

M. Sonar Echo Ranging and Listening Equipment.

No damage.

N. Sonar Echo Sounding Equipment and Altimeters.

No damage.

O. Loran Navigation Equipment.

No damage.

P. Power Supplies (Motor Generators and Filters).

No damage.

Q. Television and Teletype Equipment.

Not applicable.

R. Test Equipment (Including Frequency Meters).

LD 3	Frequency meter	Several tubes were thrown out of the sockets. None of these tubes was broken and when they were replaced the set operated normally.

S. Miscellaneous.

Type CMX 49155 Loud speaker. Ser. 1858 (For TBS).	Knocked loose of the bulkhead. When wires were connected, it operated normally.
Type COT 23211A Radio phone unit Ser. 5758(For TBL 7)	Torn loose from bulkhead. No cable broken. Resistor R201 knocked out of holder but not broken.
Type CMX 49155 Loud speaker. Ser. 2268 (For TBS).	Reception weak due to one side of audio lead from receiver jarring loose and making poor connection.
Type CRV 23172 Remote phone unit Ser. 588 (For RCK-TDQ).	Knocked loose from bulkhead. Resistor R201 broken. Relay for handset jammed.

T. Telephone Equipment.

Not applicable.

U. Direction Finders (Radio).

Not applicable.

V. Spare Parts.

No damage.

Defense Special Weapons Agency
6801 Telegraph Road
Alexandria, Virginia 22310-3398

TRC

4 April 1997

MEMORANDUM TO DEFENSE TECHNICAL INFORMATION CENTER
ATTN: OMI/Mr Bill Bush

SUBJECT: Declassification of Documents

The following is a list of documents that have been declassified and the distribution statement changed to Statement A, Approved for Public Release.

XRD-41, AD-366731
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XRD-39, AD-366729
XRD-38, AD-366728
XRD-34, AD-366720
XRD-13, AD-366725
XRD-8, AD-366699
XRD-5, AD-366697
XRD-6, AD-366698
XRD-21, AD-366708
XRD-27, AD-366714
XRD-22, AD-366709
XRD-26, AD-366713
XRD-28, AD-366715
XRD-29, AD-366727
XRD-36, AD-366722

If you have any questions, please call me at 703-325-1034.

Ardith Jarrett

ARDITH JARRETT
Chief, Technical Resource Center